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ABSTRACT

This document contains the following full and short papers on computer-assisted language learning (CALL) from ICCE/ICCAI 2000 (International Conference on Computers in Education/International Conference on Computer-Assisted Instruction): (1) "A Computer-Assisted English Abstract Words Learning Environment on the Web" (Wenli Tsou and others); (2) "A New Method for Efficient Study of Kanji Using Mnemonics and Software" (Chris Houser and others); (3) "A Study of Using Web Articles To Support College English Students' Ideas in Writing" (Hsien-Chin Liou and Hsin-Yi Yeh); (4) "A Web-Based Model of Learning Java" (Chan Wai Nelson and Andy Tsang); (5) "AWETS: An Automatic Web-Based English Testing System" (Zhao-Ming Gao); (6) "CALL with a Web-Based Instructional System in Cooperative Learning Environments" (Miwha Lee); (7) "CoCoAJ: Supporting Online Correction of Hypermedia Documents for CALL" (Hiroaki Ogata and others); (8) "Computer-Mediated Language Learning" (Shu Ching Yang); (9) "Designing for Interactivity" (Johanna Klassen and others); (10) "Developing a Web Concordancer for English as Foreign Language Learners" (Howard Hao-Jan Chen); (11) "Development and Evaluation of a CALL System for Supporting the Writing of Technical Japanese Texts on the WWW" (Jie Chi Yang and Kanji Akahori); (12) "Development of Japanese-English, English-Japanese Conversation System with Voice Reading Function and Machine Translation" (Yumemi Matsuzaki and Kanji Akahori); (13) "Development of the ELT in Taiwan Web Site for English Learning and Teaching" (Hsien-Chin Liou); (14) "Integrating Web-Based Materials into Course Design" (Lilly Lee Chen); (15) "Agents in a WWW System for Academic English Teaching" (Alexandra Cristea and Toshio Okamoto); (16) "Online ESL Learning: An Authentic Contact" (Yu-Chih Doris Shih and Lauren Cifuentes); (17) "Schema Theory-Based Instructional Design of Asynchronous Web-Based Language Courses" (C. Candace Chou); (18) "The Design of a Synchronous Computer Aided English Writing Environment for the Internet"

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(Chin-Hwa Kuo and others); (19) "The Development of a Multimedia Program for Teachers To Integrate Computers into the English Curriculum" (Ya-Fung Chang); (20) "The Effectiveness of Integrating Adaptive Computer De ice and Stimulus Fading Strategy on Word-Recognition for Students with Moderate Mental Retardation" (Ming-Chung Chen and others); (21) "Using Electronic Bulletin Board as a Virtual Community To Aid College English Learning" (Yu-Chuan Cheng and Hsien-Chin Liou); and (22) "Web Speaking: a Language Learning System in the Web (David Lo and others). (MES)

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ICCE/ICCAI 2000 Full & Short Papers (Computer-Assisted Language Learning)

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Proceedings

Content

►Full & Short Papers (Computer-Assisted Language Learning)

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Using electronic bulletin board as a virtual community to aid college English learning
Web Speaking: A Language Learning System in the Web

▲HOME

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A Computer-Assisted English Abstract Words Learning Environment on the Web

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Vocabulary is the foundation of language learning. In review of the literature, the importance of vocabulary teaching has been emphasized again but the focus on vocabulary learning has been shifted to an individualized and self-paced learning process, rather than introducing frequency list. Learners need to interact with new knowledge they are going to learn with the existing knowledge or prior experience that they already have in their learning process. This corresponds to the idea of constructivism. Gearing to the same direction, we intend to design a system for abstract word learning. Since there is no concrete image for the abstract word, its learning is more difficult. We have developed an abstract word teaching-learning system which can facilitate teaching and also individual self-learning. Through multimedia and user friendly interaction techniques, student can assess the system anytime and receive different kinds of information on one spot. The learning material was conducted on a CAI system and would be carried out over the Internet. Students need only a web browser like Netscape navigator or Internet Explorer to access the system. A pilot testing was also conducted and promising results were yield. The result indicates that the abstract word learning system can successfully improve the quality of learning and teaching environment for the abstract words.

Keywords: **CALL, vacabulary learning, abstract word**

1 Introduction

Vocabulary is the foundation of language learning. In review of the literature, after 1970s, the importance of vocabulary teaching has been emphasized again in ELT (English Language Teaching)(4). ELT educators begin to review and reconstruct the importance of vocabulary learning and teaching. The focus on vocabulary learning has been shifted to an individualized and self-paced learning process, rather than introducing frequency list. Learners need to interact with new knowledge they are going to learn with the existing knowledge or prior experience that they already have in their learning process. As Gaims & Redman (3) emphasized in their discussion, new words' learning comes from learner himself. They advocated experiencing the lexical directly and extending vocabulary according to one's own need and purpose. This corresponds to the idea of constructivism, which asserts that learners participate in their own learning progress, and acquire the knowledge in context.

Furthermore, computer-aided research has giving us vast amounts of information about how words behave and the relationship they form in real-life communication. As a result, traditional ideas about what is involved in the teaching of lexis appeared to be no longer tenable. Many researchers have studied new thinking about vocabulary teaching. For example, the learner-based teaching proponents have prompted the idea of giving their students the tool and strategies to learn independently (6 & 7). In addition, the best way to learn new words is to consider it a "problem-solving exercise in which one attempts to find the best way of mapping new learning onto old (1). "Old-established words are part of a rich network of interwoven associations. As Schmitt & Schmitt (8) claimed "If new words can be integrated into this network, those associations can facilitate their recall".

Abstract words presents more difficulty in vocabulary teaching, and studies also show that compared with concrete words, abstract words are often perceived with lower accuracy in their meaning and language usage (5). Since there is no concrete image for the abstract word, its learning is more difficult for learners. Thus, the abstract word's teaching is often avoided from many vocabulary teaching and learning materials. However, when we review elementary English learning materials in Taiwan, we found that even with beginners, a lot of abstract words are already introduced in the context. Since it is not easy for teachers to teach or for learners to learn these abstract words, there is a need for a well-designed teaching or learning materials for abstract words.

Especially, vocabulary teaching has its priority in language learning at the elementary school level. English is going to be a required foreign language for most elementary schools in Taiwan. All kinds of English teaching and learning materials are thrown in the market. However, it is not easy to find appropriate teaching materials for elementary school level. Therefore, a good word teaching-learning system that can facilitate teaching and also individual self-learning is in urgent need.

Another reason for conducting this abstract vocabulary teaching and learning material is the massive application of computer in classrooms. The computer-assisted instruction (CAI) is now available for most teachers and students. CAI is going to become a new popular way of teaching and learning. Through multimedia and user friendly interaction techniques, students can access the system anytime and receive different kinds of information on one spot as well. With this abstract word learning material, other than controlling their own learning, students can also construct their own meaning for the learning material by selecting a suitable path out of all the various ways.

Thus, based on the points mentioned above, this study is intended to design an abstract-word learning system to facilitate teaching and self-learning. We planned to implement the learning material on a CAI system. While the CAI can be used as a standalone application, we would also carry out the CAI over the Internet. Students need only a web browser like Netscape navigator or Internet Explorer to access the system. Our implementation of CAI cannot only be used as a standalone application; we will carry it out over the Internet. Consequently, students may access the CAI anytime and anywhere by simply staying online and using a web browser, like Netscape Navigator or Internet Explorer. They do not need to install related software in advance. Course providers, like teachers, further enjoy the privilege of easy administration, real-time synchronization, and simple centralized contents updating.

If this abstract-word learning system can be implemented, pupils can use this system to learn abstract words through a more interesting way according to their own learning path. They can control their learning and retrieve their memory of the newly learnt vocabulary wherever they feel like to. In addition, this system is open for submission. Users or instructors can add to the system new words or modify the existing materials. In other words, the system can be updated and the database can also be enlarged. With this system, the researchers believe that this concept of vocabulary instruction and materials can open a new area to the English vocabulary teaching-learning field.

2 Methodology

FrontPage and Flash were applied in this study to design the abstract word learning system. The abstract word learning system includes the following areas; (1) text, (2) testing, (3) discussion, (4) related web sites, and (5) help, five different areas.

2.1. Text Area

This area is the main source of leaning materials. Based on the different characteristics of each abstract word, different means of presentations are selected, for example, pictures, movie, sound effect, games, etc. Through a variety of ways of presentation, we try to solidify and build up students' understanding of the abstract words.

The words selected on the word list are from Burkhard Leuschner's (2) " 2000 most frequent words" and the five recommended elementary English materials (Let's go、Gogo Loves English、Kids、Max &Mousy and YoYo & NaNa). We selected 295 abstract words from these two different resources. However, because of the limited budget and time, only 13 were included in this pilot system.

After the learner selected the word from the word list, s/he enters the definition area. When press the read icon, the pronunciation from a real person of that particular word or a sentence can be heard followed by related pictures. In general, the whole presentation is in English; however, the Chinese translation is also available. In order to get the Chinese translation, the user just needs to move the mouse over the designated English sentence.
The three icons on the upper right hand corner (Conversation, Practice and Songs) provide extra practices. Students can decide whether they want to study further about that selected word. The purpose is to provide the opportunity for students to control their own learning path. However, as aforementioned, since different word will have different ways of presentation, the icons for each word might differ. The display and explanation for each icon are as follows.

2.1.1 Conversation

Conversation provides context of the word for learners. In this area, motion pictures are used as a tool to elicit student's interests and concretize the impression or the meaning of each abstract word. Motion pictures can provide the setting and background information about the conversation. Students can actually experience the conversation and thus have better idea about the target word. In other words, through pictures and sounds, we hope the setting of the conversation can be provided and students' interests and understanding can be triggered.

2.1.2 Song

Songs and verses are very important for language learning, especially for young children. They are one of the best media to introduce language and culture. Therefore, in this section, we hope to introduce related songs or verses to reinforce the meaning and usage of the target word.

2.1.3 Practice

This part includes Plural practice, Comparison, Which is wrong? Choose the right one, Sentence completion, and Game.

- Plural
  Plural practice is specially designed for the vocabulary "this" and "that". Through the interaction with the computer software, we hope to reinforce the plural concept "these" and "those".
- Comparison
  Through comparison and contrast practices, students can relate these four words; this, that, these and those, easily and correctly with the existence of sounds, pictures and writing.
- Which is wrong?
  This activity emphasizes on mastering the relations of these four words (this, that. those & these) to the other words.
- Choose the right one
  In addition to sounds and writing, this section focuses on the usage of wh-words. Therefore, in this activity, individual words will be selected for each blank. By doing so , students have to understand when and how to use each of the target words correctly.
- Sentence completion
  In sentence completion, synonym, (e.g. mine, yours, his and hers) is presented as a different kind of input and output practices.

Game
Because of its unique characteristics, games can facilitate learning by providing a more interesting and relaxing environment. No actual scores will be calculated for the game; however, positive and negative sound effects will be provided alone with the results.

2.2 Testing

Testing area provides learners with on line self-evaluation opportunity. Learners can control their learning and retrieve their memory of the newly learnt vocabulary wherever they feel like to. The test itself also provides keys and the instant result for each question. In general, only the basic idea of the target word is tested, e.g. spelling and usage. Learners simply move the mouse to the desired alphabet then the result (or correct answer) will be shown immediately.

2.3 Discussion: E-mail and Chatting Room

This area provides contacts for students to the outside world. Learners can discuss or share their learning experiences with one another. Furthermore, they can cooperate and complete a group project with people in another learning environment or another country. This contrasts sharply with traditional learning in which the learning is independent and lonely. Through interaction or meaning negotiation, the understanding or the abstract word is deeply rooted and widely applied.

2.4 Related web sites

Through related web sites, knowledge can be cumulated quickly. Massive amount of information can be gathered by one click. The researchers have carefully selected these web sites; thus students can spend less time and energy to gather more related information for their learning.

2.5 Help Section

All the related information about this system is available for users in this section. The necessary knowledge for operating the system and prior knowledge about web application is all included here for any online service.

With this service, learners can access the whole system without any technical obstacles and obtain the greatest effects of applying this system.

3 Conclusion

The abstract word learning system was piloted to 60 sixth grade elementary school students. According to the literature, children at the age of 11 are believed to be ready for abstract thinking. Since the focus for this system is abstract words, sixth graders (around 12 year of age) are the best subjects for the study. The pilot study shows a better learning consquence of the abstract word learning system when compared with the instruction of the teacher. In other words, the abstract word learning system can successfully help students better learn abstract English words. In addition, the survey for the experimental group shows a great liking for the learning system from the students; around 80 percent of them enjoyed learning with this system and would like to learn with this kind of system again. This indicates that the system not only effective but also interesting which is a very important element for young children's learning. The above results have confirmed the significance and the advantage of this abstract word learning system. If this kind of abstract word learning system can be developed and used in schools, both the teaching and learning quality can be improved and students will have greater joy and success in language learning.

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A new method for efficient study of *Kanji* using mnemonics and software

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Japanese children spend hundreds of hours, over nine years, studying some 2000 written characters called *kanji*. Incredibly, most foreign adults attempt to study the *kanji* using the *same* method. But without these hundreds of hours, their efforts generally fail. In *Remembering the Kanji,* James Heisig presents a radical method for studying *kanji*. In only 200 hours, Heisig claims, adults can learn the *kanji*. A wonderful improvement! But few students follow his method; most complain that 200 hours is still too long. This paper introduces a refinement of Heisig's technique, a refinement combining modern memory theory with software, a refinement reducing the required time to 40 hours. The first author, a forgetful *kanji* neophyte, learned the *kanji* with this method, studying an hour a day, five days a week, for two months. His recall exceeds 95%, approximating native Japanese. This paper targets both teachers and students of Japanese as a foreign language, providing the knowledge and software required to rapidly learn the *kanji*, and inviting them to participate in a wider experiment using these new technologies.

Keywords: **CALL, Kanji, SuperMemo, Efficient study**

1 The *Kanji*

Perhaps the most difficult part of learning Japanese is memorizing its enormous character set: the 2000-odd *kanji*. These characters were imported from China into Japan. Because each character was imported several times over the centuries, while the Chinese and Japanese languages were evolving, each character now has multiple readings and meanings. As a result, the Japanese writing system is arguably the world's most complex.

Japanese children study these *kanji* for hundreds of hours over nine years of schooling. They start studying when six years old, before they have developed the ability to abstract, and hence can learn the characters only by *muscle memory:* They write the characters repeatedly, typically 20 times each. This method works, but imperfectly: Even after all this study, and the review that comes with daily use, adult Japanese forget some characters.

Most foreigners studying Japanese as a foreign language (JFL) try to learn the *kanji* using the same method: They write the characters repeatedly, perhaps while verbalizing the character's meanings and readings [7]. But since few adult JFL students have the hundreds of hours this method requires, most fail [4].

2 Heisig's method for studying the *kanji*

Heisig [4] offers an alternative study method.
Goal. Heisig's method allows adult JFL students to learn the *writing* and a *single meaning* of 2042 *kanji*. This is a narrow goal: Students concentrate on learning this writing and single meaning, and postpone learning other meanings, all readings, and the multiple character compounds.
Method. Since Heisig targets adults, he is able to use a sophisticated method, a method beyond the grasp of six year olds. He is able to use a *rational* method for learning *kanji*. Heisig prepared his method by

1. assigning each character a *keyword* (its single meaning),

2. splitting each character into a handful of *parts*,
3. ordering the characters so that parts precede their uses, and
4. inventing a mnemonic story to help recall each character's parts.

The keyword is usually the most common of the several Japanese meanings. The parts come from various sources: Some are simpler *kanji*; others are *primitives* – collections of commonly occurring strokes. Some of these primitives were identified centuries ago by Chinese and Japanese linguists (who call them "radicals"); other primitives were simply invented by Heisig. In all, Heisig uses a few hundred parts. The crux of his method:

Each character is learned, not as a mass of random strokes, but as a logical collection of parts.

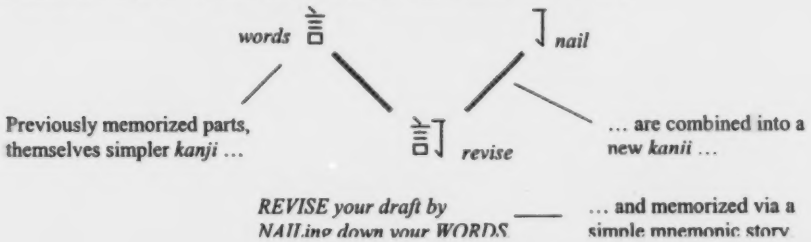
For example, consider the kanji with the keyword revise. This character has **nine meaningless strokes**, which prove quite a challenge to remember. But this same character has only **two parts** with the keywords *words* and *nail* – **meaningful** words which are much easier to remember. In effect, Heisig splits this character into these two parts, making a kind of equation: *revise* = *words* + *nail*. Most non-Japanese find this equation much simpler to recall than a meaningless jumble of nine strokes. When Heisig's students[1] come to study *revise*, they have already learned the two parts – *word* and *nail* – since Heisig has sorted the *kanji* so that these parts precede their use in *revise*. By combining two previously learned parts, students easily remember this new character. But Heisig makes remembering even easier by providing a **mnemonic story**:

REVISE your draft by NAILing down your WORDS.

The image of "nailing down one's words" is so strong and logical that after students have read this mnemonic **once**, they will likely remember it for life.

This contrasts with Japanese students, who practice **writing** the character **repeatedly**, and may later forget it.

Heisig's main contribution is to **raise the level of abstraction** from strokes to parts. Rather than struggling to remember a large, sprawling jumble of meaningless jots and dashes, students effortlessly remember a simple story, calling to mind the few parts that compose a *kanji*:


words
nail
Previously memorized parts, themselves simpler kanji ...
revise
... are combined into a new kanji ...
REVISE your draft by NAILing down your WORDS
... and memorized via a simple mnemonic story

Study. Heisig has done most of the work: He has assigned the keywords, identified the parts, invented the primitives, and sorted the *kanji*. Students need only read the keyword and story a few times to memorize each *kanji*. Heisig predicts study will require 200 hours – far less than Japanese children spend on rote repetition.

Analysis. Why is Heisig's method so effective? Here are three explanations.

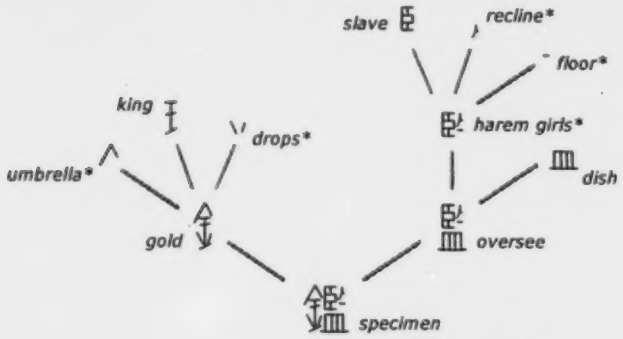
Simplicity. The stories are simpler than the *kanji*, simpler because they have fewer components. Each *kanji* consists of between 1 and 23 strokes; 75% of the *kanji* have more than seven strokes. But all have fewer than seven parts. Now human short-term memory can hold only about seven items [6]. Objects with more than seven known components cannot fit in short-term memory, and so cannot be remembered, or even recognized. This predicts that students learning strokes will remember 25% of the *kanji*, but students learning parts will remember 100%.

Abstraction. Practicing strokes engages only muscle memory: Most of the student's brain remains dormant. Heisig's stories engage the higher faculties of language, actions, settings, events, humor, and metaphor. Such meaningful symbolic processing engages more of the brain, and hence is more easily recalled, than mere orthographic syntax [8]. Humans recall abstract meanings and stories long after they forget specific examples and images [5].

Relations. When learned by rote, each *kanji*, indeed each stroke, must be learned anew: Nothing is connected to anything else. When learned by parts, each *kanji* is connected to previously learned *kanji*.

Heisig's method is rich in connections. When students learn a character, they are also reviewing its parts. In turn, most parts appear repeatedly, and hence are memorized easily.

As an illustration, consider the daunting 23 strokes of *specimen*. Stroke-by-stroke memorization is all but impossible. But *specimen* comprises only two parts: *gold* and *oversee*. It is easily recalled with a story such as *GOLD diggers OVERSEE their mineral SPECIMENS. Specimen* is studied after *gold* and *oversee* have been learned, from their own parts, with their own stories. So each step of study is small and simple, but the steps build on each other – primitives are woven into *kanji*, which are in turn used to build further *kanji* – until a vast web of rich connections is built up in the student's mind.



Parts are either simpler *kanji*, or *primitives* (marked with *)

Problem: Still too difficult! Heisig's method is a great improvement over the Japanese method, but it is not perfect. For Heisig provides stories for only the first 500 of his *kanji*, and asks readers to invent their own stories for the remaining 1542. Faced with this burden, many of Heisig's students stop studying after 500 characters. And those who do continue need unusual discipline, need to painstakingly construct and review flash cards, need a scheduling system to study, review, and test.

3 Kanji Can

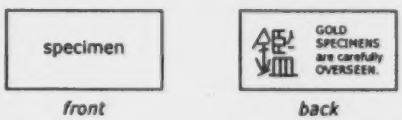
Kanji Can [3, 1] is a database with a *complete* set of 2042 mnemonic stories. The stories are excellent, surpassing even Heisig's first 500:

- Kanji Can's stories are shorter, and so easier to recall.
- Kanji Can's stories mention the parts in the order they are written.
  (Compare with Heisig's story for *revise* above, which reverses them.)

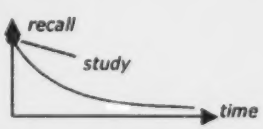
Kanji Can embraces Heisig's method, but extends his materials, and thus solves the problems mentioned above.

4 Flash Cards

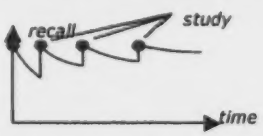
The chief tool of most memorizers is the humble flash card. Flash cards are small paper cards with a *stimulus* written on the front side, and a *response* on the back. When studying foreign language vocabulary, the stimulus is typically a word in one's native language, and the response is the word in the foreign vocabulary. When studying *kanji* using Heisig's method, the stimulus is the keyword, and the response is the *kanji* itself.



Students read the stimulus and try to produce the response. They then check their response against the desired response on the back of the card. Cards that were correctly recalled are removed from the deck; cards not recalled are shuffled to the back of the deck, to be reviewed again. Used this way, flash cards combine self-testing with review. The cards catch mistakes and save them, allowing review until the student knows them all. Flash cards



Memory fades after



Repeated study slows

are essential when following Heisig's method: Studying the stories is so easy that students will doubt they are really learning anything until they have been tested!

Problem: Inefficiency. Using flash cards takes a lot of time. Each card must be hand made. Then each card must be tested repeatedly, for only with repetition comes dependable memorization. Memory fades over time, but by reviewing partially forgotten material students extend their memories.

But how frequently should students review? Buzan [2] recommends review after ten minutes, a day, a week, a month, and then four months. But are these the best intervals for review? Testing too frequently wastes time reviewing material already well known. Testing too infrequently wastes time relearning forgotten material. The goal of flash cards is to "catch" learners just before they fall – to remind them just as they are about to forget. But the point of forgetting – and hence the optimal review interval – differs for each student, and even for each *kanji*: Some are easier to remember than others. How can we optimize study?

5 Super Memo

Super Memo is a general flash card program [9]. Like paper flash cards, these electronic cards can be used to review anything, including the *kanji*. Unlike paper cards, these electronic cards are neat and easily editable, but require a PC. Super Memo is better than paper flash cards because it contains a mathematical model of human forgetting: It can predict when a student will forget a *kanji*, and hence compute the best testing time. When testing with Super Memo, students tell the program how well they remember each *kanji*; the program uses this information to tune its model to each student, and to each *kanji*. The result closely approximates perfectly timed intervals, and hence maximum efficiency in studying.

Independent of the nature and amount of material they study, students using Super Memo all learn approximately 200 items/minute/year. This means that by studying one minute, every day, for a year, one can learn 200 items; or, by studying 10 minutes a day, 2000 items. This is much faster than many other study methods; in particular, Super Memo implies results in 1/5 of Heisig's time.

Super Memo's computerized scheduling provides more than optimal reviews. It also provides an incentive to study every day. A student using Super Memo runs the program every day and finds a list of items to review. If the student skips a day, the next day she will be confronted with twice as many items! This threat helps provide the discipline necessary in learning a large body of material, such as the *kanji*. (Unfortunately, this also means that if the student skips a week, she will be confronted with a mountain of review, and will likely quit altogether. Super Memo is not for the timid.)

6 New technology allows learning the *kanji* in only 40 hours!

This paper proposes a new method for learning the *kanji*, a method combining Heisig's novel ideas, Kanji Can's stories, and Super Memo's reviewing. Heisig provides the tractable goal and the idea of using mnemonic stories to recall the writing of *kanji* in terms of their parts. Kanji Can provides a complete set of these mnemonic stories. And Super Memo provides strict scheduling and efficient reviewing and testing. The combination of these three educational technologies provides a most efficient *kanji* learning method: the complete set of 2042 *kanji* can be learned in only 40 hours!

These 40 hours might be scheduled as 10 minutes a day, every day for a year, or an hour a day, five days a week, for two months. Memory manuals claim that an hour's study a day is optimal: Shorter study sessions waste time in frequent physical and mental preparation, longer study sessions induce fatigue, and both degrade efficiency [2, 5].

The first author learned the *kanji* in 40 hours by following this method.

Heisig has greatly accelerated *kanji* learning for adult JFL students. Kanji Can's complete set of stories enables students to concentrate on studying the *kanji*. Super Memo provides a well-documented speedup for any rote memorization. Combining these three technologies, we can learn the *kanji* in only 40 hours.

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A study of Using Web Articles to Support College English Students' Ideas in Writing

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Among various Internet resources, the World Wide Web (the Web) becomes very popular recently and plays an influential role in English learning. This study aims to explore how college-level English learners in Taiwan cite reading materials on the Web to write their own compositions. Fifteen college sophomores were required to write a source-based paper using electronic resources on the Web. It was found that those who have higher reading proficiency and more previous Web experiences write better souce-based papers. Also, the subjects were able to obtain the gist of others' Web articles and organized it into their own compositions. The quality of citation was quite good, although the subjects relied on quotations from others' Web articles to support their own ideas.

Keywords: **Web-based learning, source-based papers, World Wide Web**

1 Introduction

In the Information age, college students and professionals have more and more opportunities to search for information on the Internet and the World Wide Web. Reading on the Internet is unlike traditional reading. Much has been claimed about the prevalence of hypertextual discourse and its possible impact on education. It is believed that reading on the Web, using the selected information, and making meaning on texts out of the synthesized results will become modern people's common ways of literacy practices—including communication, meaning-making, and knowledge production—in the near future. Moreover, in order to use the resources on the Web to aid their own language learning, learners have to identify their learning goals, search for information matching their goals, and discern relevant information in the vast amount of Web resources. Such a process is quite similar to the nature of source-based writing—integrating relevant information from other specialists' articles into one's own article to support one's own views. It is thus worthwhile to examine how college students go through the process and what the pedagogical implications such exploration may provide. However, there is not much done on source-based second language (L2) writing, based on our review of the literature. Also, hypertext reading and writing using electronic sources on the Web still remain unexplored in the foreign language (FL) learning/teaching areas, including Teaching-English-as-a-foreign-language (TEFL).

In view of lack of studies about the effects of using electronic sources on the Web to write source-based L2 writing, the study aims to explore the ways in which EFL learners integrate English reading materials on the Web into their own compositions via the two questions:

When FL learners use electronic sources on the Web to write source-based academic papers,
does their reading ability, previous Web experiences, and the amount of time they search and use sources on the Web have an impact on students' writing performance on such a task?
how well do learners in this study use citation strategies in source-based writing ?

2 A review of the literature

In this section, the literature on the relationship between reading and writing, source-based writing, and language learning on the Web are reviewed in order to provide a theoretical framework for this study.

2.1 The relationship between reading and writing

Based on Eisterhold's viewpoints [1], reading and writing have inseparable relationship and certain features transfer between these two domains. Studies on the reading-writing relationship in both native speakers of English and ESL students provide evidence that there is "reciprocal relationship between reading and writing" [2]. Correlational studies of reading and writing performance also confirm that " (1) better writers tend to be better readers; (2) better writers read more than poor writers; (3) better readers tend to produce more syntactically mature writing than poorer readers" [3]. To be more specific, Melanie [4] stated that reading and writing share common cognitive process, vocabulary and linguistic rules. In the process of reading and writing, learners have to deal with information encoded in the format of punctuation, spelling, and grammar. This kind of structural knowledge not only facilitates learners' reading comprehension but also aid them to organize their compositions logically and cohesively. Moreover, in order to use information from reading texts in their own compositions, they also have to undergo cognitive processes such as getting meaning, questioning ideas in texts, hypothesizing, organizing and evaluating the ideas, and clarifying their own thoughts in their final written product. Such a process enables learners to discover others' opinions and develop their own beliefs and thus enhances their own knowledge about writing and reading.

The benefit of reading to write can be discussed in two ways: the impact of reading models on writing and source-based writing. Reading articles written in specific genres gives readers opportunities to build on "schematic knowledge of genre" [5]. Being exposed to reading models, they also learn formats of the genres, know audience expectations, and discover opinions they can write about in their own papers. Spivey and King [6] reported the influence of reading models on writing by examining descriptive report written by 60 students from a public school in northern Texas. The subjects were categorized into more skilled and less skilled readers by their reading scores of the Comprehensive Test of Basic Skills. Over a three-day period in their language arts/English classes, the subjects were asked to write a report on the topic "rodeo"— the special activities held in Texas at that time. Three encyclopaedia articles on "rodeo" were given to students as reading models and their products about the report (including scratch paper, planning pages, drafts, and the final report) were analyzed to distinguish ideas they selected from the three source texts as well as content they added. Results showed that more skilled readers were more likely to include important ideas across the reading models into their compositions and made use of text structures to organize different ideas into the content of their compositions. Charney and Carlson [7] also investigated the usefulness of writing models on students' writing of research texts and the effects of models of different quality. The control group (subject number, N=22) saw no models whereas the models groups (N=73) were provided with either three good models (AAA) or one good, one intermediate, and one poor model (ABC). These models were experimental reports written by students in previous semesters of the same psychology course. Results showed that the models groups' texts were better organized than those of the control group. Moreover, there was no significant difference between subjects provided with three good models and those with models representing good, moderate, and poor quality. The authors concluded that models did have an impact on the content and organization of subjects' texts. That is, providing models of different quality (good, moderate, and poor) may help students identify the effective aspects of the good models and avoid making mistakes in their own compositions. Students may also infer from models if it is appropriate to include or exclude certain ideas in the texts.

2.2 Source-based writing

Based on the review of literature, there is no clear definition of source-based writing. The only synonym—discourse synthesis—has been defined by Sprivey as "a form of reading-to-write that involves readers (writers) in the process of creating new texts by organizing, selecting, and connecting content from more than a single source text" [8]. Studies which investigate the ways readers/writers compose new texts by selecting, organizing, and connecting ideas from source texts are discussed as follows.

First, Campbell [9] studied source-based writing for both native and non-native writers at college level. Based on their scores of SAT English Composition Achievement Test, twenty non-native speakers were further categorized into less proficient nonnative speakers and more proficient nonnative speakers. Thirty subjects in five composition classes were asked to write an essay in class within one hour on the topic "fraternities and/or sororities" by using concepts in a source text from an undergraduate anthropology

textbook. The resutls showed that patterns associated with student groups and sections of composition. In the first paragraphs of their compositions, non-native speakers used significantly more information from the source text than the native speakers did. In the body paragraphs, all the students used concepts from the background text as well as many of their own ideas. In the final paragraphs, both native and non-native speakers used significantly more information from the source than in their body paragraphs. The results showed that copying concepts from the source text was the primary method for the university students in the study to write their in-class compositions. Campbell suggested that a way to decrease the rate of copying is giving students ample opportunities to practice source-based writing, giving students writing assignments that use information from source material, and informing students of various methods of citing sources in their compositions. Besides, teaching source-based writing to non-native speakers should focus on the importance of using source materials to support their ideas rather than to govern the content of their compositions. In order to develop academic style in writing, it is important for students to read plenty of academic articles that have reference to other academic works as well as noticing how various concepts are integrated into such source-based articles.

Feng [10] investigated the writing process of two EFL graduate students when they used two reading texts to write academic papers in English. One of the two subjects was a more skillful writer and the other was less skillful. They were required to read two academic articles concerning the use of L1 and L2 in the foreign language classroom. Based on the two articles, they had to write an academic paper which discussed the use of L1 in EFL context such as Taiwan. Think-aloud was used to collect data when the two subjects read the two articles. Their writing process were videotaped. The results showed that during the composing process, the more skillful writer had more effective planning strategies and made more changes in meaning than the less skilled writer. The more skillful writer read the two sources more analytically and critically whereas the less skilled writer read in order to quote from the sources. Feng stressed the importance of "higher level reading skills" (p. 318) when students read academic source papers in order to write. She also suggested that the teacher should help students make more elaborate writing plans when composing from sources.

Based on the findings of the studies, we can conclude that more proficient readers and writers are able to extract ideas from sources in print to facilitate their language learning. However, there is not much known about how more proficient learners use sources on the Web to write academic papers.

2.3 Language learning on the Web

The educational use of the Web can be divided into three categories: studies on general learning on the Web, personal views of Web literacy, and studies which focus on English reading and writing on the Web. In the past ten years, the Web gains its popularity as a communication tool and as a media of general learning on the Internet. A brief survey of the literature shows that studies on learning in a hypertext environment can be summarized as following. Some studies [11, 12] focus on the design features for hypertext, such as what kinds of navigation aids prevent learners from getting lost in millions of Web sites. Other studies [13, 14] investigate the relationship between organization patterns of hypertext and learning styles of language learners. Still others [15, 16] aim to find out what kind of learning tasks are suitable for being carried out and what kind of learners are fit for learning in a hypertext environment.

Disadvantages of foreign language teaching/learning on the Web are mostly related to technical problems, such as technical interruptions, time delays in showing images, and constant changes of URLs of Web sites. Technical advantages of Web learning include global accessibility and twenty-four hour availability; pedagogic advantages include students' learning at their own pace and rapid retrieval of information. Also, reserachers [17, 18] emphasize that the most influential impact of the Web on language learning is the notion of self-directed-learning, which stresses a learner's individualized needs and learning at one's own pace.

If learners intend to use Web materials to fulfill their pedagogical needs, certain Web literacy is needed. Thomas [18] defines literacy on the Web as "the ability to find, evaluate, and use information." A number of researchers [19, 20] agree that the skills of information access, location, analysis, and evaluation are basic requirements in terms of efficient learning on the Web. In other words, locating and finding relevant Web resources for the task are related to Internet search skills (Web literacy). Organization and synthesis of relevant information belong to learners' writing ability. To what extent learners successfully define their tasks, determine the priorities of Internet resources available, and extract relevant information depends on their reading ability and higher order cognitive abilities. However, the entire complex process still remains unexplored in the foreign language teaching/learning field.

Besides studies prescribing users' literacy on the Web, Liou [21] investigated how the Web influences EFL college students in the aspects of writing, reading, vocabulary development, and understanding of global issues. Fifteen juniors in the experimental group were required to browse news on the Web sites given by the instructor, select a news article to read, and write a response journal based on the article. Eighteen juniors in the control group took regular writing course without reading news on the Web and writing response journals. The project lasted for a semester. It was found out that the experimental group outperformed the control group in writing. Also, students used Web resources held positive attitudes toward the Web and two-thirds of them kept using the Web after the project finished.

To sum up, using information on the Web has become quite popular for teaching and learning English in the ESL and EFL contexts. However, hypertext reading and writing using electronic sources on the Web still remain unexplored in the TEFL field. Due to the lack of empirical studies about using reading materieals on the Web to write academic papers, this project will be conducted to explore the relationship between readng proficiency, Web search, and writing performance. The study also aims to examine how college EFL learners in Taiwan use reading materials on the Web to do source-based writing.

3 Research method

The context for this study was a source-based writing project in Taiwan which involved reading and writing activities used by an intact group of college sophomore English composition course. The fifteen subjects, all female and English majors, received at least one year training on four skills in English in addition to six-year formal English instruction at high schools.

3.1 Research procedures

Before the project, a reading section of TOEFL were used to measure the subjects' reading proficiency; a questionnaire investigating their former Web experiences. As part of the course's syllabus design, students were required to write a source-based paper using electronic references on the Web based on their choice of topics of their own interests. Besides, the subjects were required to use search engines like *Yahoo* to search Web articles relevant to their topic. It took three weeks for the subjects to write and revise their source-based papers. The process involved identifying a topic, searching the useful Web sites and recording them on an off-line Web use log designed by the researcher, selecting relevant Web articles, selecting supporting ideas from the articles, and incorporating these ideas into students' own compositions. An end-semester questionnaire was used to obtain students' attitudes toward such a writing process. Students were required to turn in all documents in the process including Web articles they cited.

3.2 Data analysis

Data analysis involved quantification of variables, statistical analyses, and qualitative coding. For quantification of variables, see Table 1.

Table 1: Data Analysis

Variables	Detail	Instruments
Reading abilities		The reading comprehension section of the TOEFL test, 1998 [22] (Range: 0-100 points)
Web search	Previous Web experiences	Questionnaire of Web experiences (quantified based on a five-point scale)
	Amount of Web search	Two-week Web log—the amount of time a subject spends on searching and browsing the Web (Unit: minutes)
	Attitudes toward the Web	1. Questionnaire of Web experiences (quantified based on a five-point scale) 2. Questionnaire of attitudes (quantified based on a five-point scale)

Variables	Detail	Instruments
Writing performance	Source-based paper	1. Quantitative aspect—Overall writing ability which is measured using ESL Composition Profile [23] (Range: 0-100 points) 2. Qualitative aspect—Citation strategies (1) Types of citation—quotation, paraphrase, summary (Unit: frequency) (2) Relevance judgement (essential, relevant, and irrelevant) of the three citation types

For statistical analysis, Pearson product-moment correlation coefficient which was conducted to examine the correlation between students' TOEFL reading scores, previous Web experiences, Web search, and scores of the source-based paper. Qualitative coding of citation strategies in the subjects' source-based papers included citation types and relevance judgment of the citation types. First, citation types in Campbell's study [9] were simplified to three types: quotation, paraphrases, and summaries. Second, relevance judgments which were proposed Charney and Carlson [7] were simplified into a three-point scale (essential, relevant, and irrelevant) in this study and the scale was used to rate the appropriateness of three citation types (quotation, paraphrases, and summaries) in the subjects' composition. The results might shed light on citation strategies of EFL learners in Taiwan.

4 Results

4.1 Relationship between reading ability, Web experiences, Web search, and writing performance

In order to find out the relationships among the subjects' reading ability, previous Web experiences, Web search amount, and writing performance of citing Web sources in EFL context, Pearson Product-Moment Correlation Coefficient was conducted. The results are given in Table 2.

Table 2: Correlation among Reading Ability, Web Search Amount, Previous Web experiences, and Writing Performance

	Reading ability	Web search amount (mins)	Previous Web experiences	Writing performance
Reading ability	1			
Web search amount (mins)	0.06	1		
Previous Web experiences	0.60	-0.42	1	
Writing performance	*0.70	0.05	0.55	1

$p < .05$, N=15 (Two-tailed) *statistically significant

The correlation between the subjects' TOEFL scores and source-based papers was .70 ($p<0.05$). Because the subjects' reading abilities were positively correlated with their writing performance, the assumption that a more proficient reader is also a more proficient writer appears to be supported. Moreover, the correlation between the Web search and source-based paper was .05 ($p<0.05$). Since there was no significant relationship between their amount of Web search and writing ability, it indicated that the subjects' writing performance was not closely related to the amount of time they spent searching and using sources on the Web. Furthermore, the correlation between the Web experiences and source-based paper was .55. Perhaps Web experiences is a better indicator of students' writing performance in citing electronic sources to write formal papers than Web search does, but the coefficient is not significant. Also, the correlation between Web search and previous Web experiences was negatively correlated (-0.42), though not being high up to a significant level. It might indicate that the more experiences the subjects had in using hypertextual resources, the more familiar they were with the possible formats and contents on the Web, which might contribute to the less time and efforts they took searching information on the Web in order to finish the source-based papers.

4.2 Previous Web experiences and attitudes toward the Web-related writing tasks

The results of the two questionnaires are examined in order to probe students' previous Web experiences and their attitudes toward the Web-related writing tasks. It was found out that although most of the subjects

assumed positive attitudes toward the use of Web sites, their previous Web experiences was quite limited. 30% were newcomers to the Web, who have used the Web for no more than a year. 80% were not well-experienced users, whose Web experiences were below two years. Despite the fact that all of them have used search engines, 73% had difficulty locating information they need on Web sites in English. Only 33% agreed that they could find relevant information on English Web sites. Furthermore, although most of them deemed English Web sites as a tool to facilitate their English learning, few of the subjects (13%) browsed Web sites in English often enough and only one-third of the fifteen students liked to use English Web sites. To sum up, the subjects assumed bittersweet attitudes toward searching and browsing Web sites in English. There are two possible explanations of their behaviors: their browsing behaviors on the Internet and their language proficiency. One possibility is that they couldn't find what they need by using English search engines. Also, the less they browsed the Web sites, the less practice they would have finding and extracting information from the Web sites. The less they were familiar with the Web sites, the less information they would be able to find on the Web. This is so-called a vicious circle. The other possibility is that half of them didn't think their English was excellent enough to handle the contents of English Web sites. 53% said that browsing English Web sites made them nervous because their English ability was not good. 47% reported that they felt discouraged when there were too many words they didn't know in the Web texts.

When it comes to Web-based source writing, four-fifths of the subjects agreed that the availability of data on the Web was related to the types of topics they chose for source-based writing. That is, the more popular a topic is, the more people would like to discuss it on the Web and the easier to locate prevalent and general information about the topic. Moreover, two-thirds of the subjects agreed that browsing relevant articles on the Web did help them in writing source-based papers in comparison with materials in print. The benefits of using hypertextual articles to write source-based papers include giving students inspiration to organize their compositions, finding references in related articles, locating evidences to support their own ideas, reading data written in different formats, and practicing writing in a formal style.

4.3 Citation strategies in source-based papers

Three citation types were coded and counted in students' source-based papers: quotation, paraphrase, and summary. The results showed that the most frequently-used citation types in the subjects' source-based papers were quotation (43%), followed by paraphrase (32%), followed by summary (25%). According to Campbell (1990), quotation was the least integrated citation type in students' compositions whereas summary was the most integrated one. Compared with the percentage of the other two citation types (75%), summary—the type which requires students to obtain the gist of others' articles—occupied only 25% of citation types in students' compositions. Therefore, the results of the study seem to confirm that Chinese EFL learners rely on others' exact words to construct their own compositions.

Second, relevance judgements of the citation types are used to investigate how well the subjects incorporated ideas in others' articles into their own compositions. It was found that citations which were relevant to the students' compositions occupied the highest frequency (51%), followed by essential (40%), followed by irrelevant (9%). The distribution of the relevance judgment of each citation type was shown in Table 3.

Table 3: Quality of each citation type

	Essential	Relevant	Irrelevant	Total
Quotation	37%	53%	10%	100%
Paraphrase	17%	66%	17%	100%
Summary	74%	26%	0%	100%

The results indicated that summary was the best-used type because 74% of summary were incorporated into the subjects compositions as essential information and none of it was rated as irrelevant information in students' source-based papers. Quotation was used quite successful in the subjects' papers because 90% of the type was rated as essential and relevant. Paraphrase was the least successful citation type in students' source-based papers because only 17% of it was rated as essential and nearly one-fifth of it was regarded as irrelevant information.

The results also showed that although summary was not quite common in their papers (25%), once it was used in the subjects' papers, its quality was better than the other two citation types. The results also suggest that when citing others' concepts, some students had difficulty paraphrasing the most essential part in the

others' articles. They often spent a lot of space beating around the bush, repeating main plots in others' works without organizing them into their own papers. Furthermore, since 10% of the quotations in students' papers were irrelevant, it suggests that students should take more efforts to integrate the quotations into their own papers rather than put those quotations in their papers without justification.

5. Conclusion

Based on the results of this study, those who have higher reading proficiency and more previous Web experiences performed better when citing electronic sources on the Web to write source-based academic papers. It seems that more proficient readers are able to organize different ideas of Web sources into their own papers and that more experienced Web users had no difficulty locating and citing relevant source information in their papers. Moreover, the subjects were able to gain the gist of others' Web articles and organized the main ideas into their own compositions. Although the subjects in this study relied on quotations of others' texts to support their own ideas, the quality of quotation was as good as possible. In contrast, some of the subjects had greater difficulty paraphrasing others' concepts into their papers.

According to the fifteen subjects in this study, the advantages of using Web sources to write compositions were substantiating the content of their compositions. Its disadvantages included spending a lot of time without finding relevant articles on the Web and not knowing how to pick up the most appropriate text from the vast amount of sources on the Web. Therefore, if the teacher wants to use Web sources to aid students' ideas in writing, there are three things to which s/he should pay attention. First, students need guidance to learn how to use search engines well enough in order to locate relevant and in-depth Web sources. Second, the teachers should offer academic Web text models in class so that students can be more familiar with the organizing patterns of Web texts. Third, students should be taught how to differentiate good sources from bad ones as well as how to cite sources into their compositions. The teacher should emphasize that Web sources are used to support students' own ideas rather than governing the content of their own papers.

This study investigated how students' reading ability, previous Web experiences, and Web search amount influenced their source-based writing performance. The study also explored students' citation strategies in EFL context, including the format, types, and relevance of citation. Besides the pedagogical implications for integrating hypertextual sources into English writing instruction, the contribution of this study is that it was the only study in Taiwan that probed students' types of citation and relevance of citation when using English sources on the Web to write academic source-based papers. However, only fifteen subjects in an EFL context were involved in the study and it might be difficult for researchers in other contexts to draw inferences without further studies. Besides, the fifteen subjects in this study were allowed to choose three types of topics in writing source-based papers: a review of a book or a movie, a report of a well-known person, or a social issue. Although the freedom of topic selection reflected the notion of self-directed-learning—the most influential impact of the Web on language learning, it increased the difficulty of grading. The two raters had to discuss the grading criteria for each topic type. They also tried to be as fair as possible when grading fifteen pieces of papers with fifteen distinct titles. Future studies need to be aware of the issue of topic selection. Finally, the fifteen subjects' on-line activities on the Web were only reported by themselves in the Two-week Web Log. There is still room for qualitative studies which investigate students' on-line behaviors and their writing process when using hypertextual source sources to write academic papers.

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A Web-based Model of Learning Java

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This paper proposes the architecture of a VL model for computer-assisted-learning in Java. VL is an acronym that stands for Visual Learning. There are three important components in the VL model, namely Code Book, Dictionary and Play. In addition, a number of modules have also been built in order to provide better support to the VL model. These supporting modules are the Object-oriented Concept module, the Java Language Concept module, and the Problem Case module. All these components and modules are posted to a Web and made available for student access. A prototype has been developed for the purpose of studying the feasibility and operations of the VL model. The study and development of the prototype is a project funded by the teaching development grant of the University Grants Committee (Hong Kong).

Keywords: **Computer-assisted-learning, Code Book, Dictionary, Play.**

1 Introduction

Motivating students to learn is a difficult task since the dawn of civilization. It is even more difficult when the content involves a programming environment and a design methodology [Borne 1993]. However, with the aid of the modern computing technologies, the difficulties can be substantially reduced if a good design of visual programming environment [Zhang and Zhang 1998] can be implemented. Before we present how the computing technologies being incorporated into our model, it is worthwhile to investigate how motivation can be invoked from students' points of view. First of all, students are keen in

- What knowledge they will be learning?
- How to apply the knowledge in solving problem?
- How to apply the knowledge to an application?
- Is the knowledge easy to learn?

In the context of our Web-based model for learning the Java language, the first three concerns can be dealt with no difficulty. The first concern is easy to clarify. Most of the computing students know that the Java language is one of the state-of-the-arts of computing languages. For the second concern, we use the problem-base learning [Savery and Duffy 1995] as our teaching methodology in our Visual Learning model. Hence, students are able to apply the knowledge in solving problems. The third concern is quite critical. We intend to build the VL model using an application that most students are familiar with, for example, a cinema ticket booking system. After the students attended all the lessons, they should be able to build systems of similar application. The final concern is the most difficult to be realized by students. For this purpose, we have to rely on the modern computing technologies together with some design constraints. These design constraints are:

- Each lesson is consisted of a number of sessions.
- Each session is a stand-alone Java application.
- Each session is used as a building block for the next session.
- Information loading in each session must be minimized.
- Explanation facility for each session must be adequate and user-friendly

This paper intends to present the framework of the Visual Learning model. The VL model and its supporting modules are posted to a Web site. There are three supporting modules, namely the object-oriented concept module, the Java concept module and the problem case module.

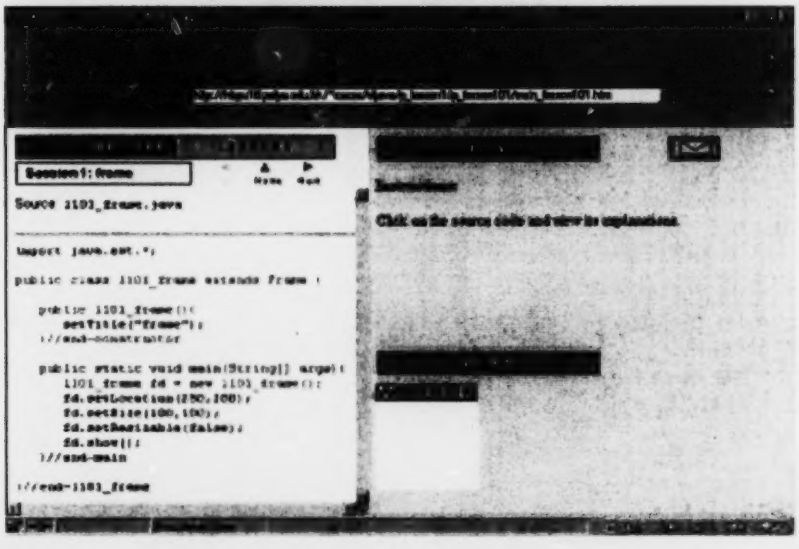
2 Supporting Modules

The object-oriented concept module provides students a foundation on the features of object-oriented constructs. These include the concept of world, class, object, event, stored data, method, message, inheritance, information hiding and etc. The Java concept module provides students some language constructs corresponding to the concept mentioned in the object-oriented module. The problem case module is a set of Java problems that require students to work on either as a group or an independent project. To monitor the group work, chat rooms are available for each group of students to present or discuss their problems [Cleaver 1999].

3 Visual Learning for Java Module

The Visual Learning module is the core module of the VL model. It consists of a number of lessons, and each lesson is made up of a number of sessions. The Visual Learning model is constructed based on the consideration of the design constraints mentioned previously. The first page of the module is a table of contents that provides students an overall view of what they will learn. There are six lessons for this ticket booking system. Lesson 1 is an introduction that provides students a feel of how frame and widgets are being created. Figure 1 indicates that Session 1 of Lesson 1 has been selected. To avoid information loading, the screen is divided into three components, namely Code Book, Dictionary and Play.

Figure 1. Selection of Session 1 of Lesson 1



Lesson 2 is the continuation of Lesson 1 except that it provides students the concept of panel. Both Lesson 1 and Lesson 2 involve no interaction of widgets, such as radio buttons. Lesson 3 provides students a foundation of interaction technique using widgets. Lesson 4 involves text input and some basic control structures. Both Lesson 5 and Lesson 6 relate to information storing and information retrieving.

3.1 Code Book

The leftmost section is the Code Book component. It contains all the Java coding that is required to generate

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the content as indicated by the title of the session. In this example, the coding is to generate a frame, as indicated by the title of Session 1. If the coding cannot be contained within the Code Book component, students are required to use the vertical scroll bar in order to see the hidden coding. To run the Java coding of this session, simply copy the contents into a text file followed by a compilation and execution.

3.2 Dictionary

The upper right hand section is the Dictionary section. Initially, this section is empty. A directive is displayed under the "Instructions:" text. It suggests to the students that a line of coding must be selected from the Code Book section. When a particular line from the Code Book section is selected, this line will then be appeared in the Dictionary section as depicted in Figure 2. All Java reserved words are expressed in black color, all user defined entities are expressed in red color. So far, the Dictionary facility has not been triggered. To invoke the Dictionary facility, the mouse pointer must point closely to the entity of interest. Therefore, students if so desire to use this facility, the mouse pointer must be pointed closely to the targeted entity. When the targeted entity turns its color to green, and at the same time, an explanation note will be displayed. If the mouse pointer moves away from the targeted entity, the note will be disappeared and the entity will restore its original color. Students may select another line from the Code Book to inquire the explanation of other entities in other lines.

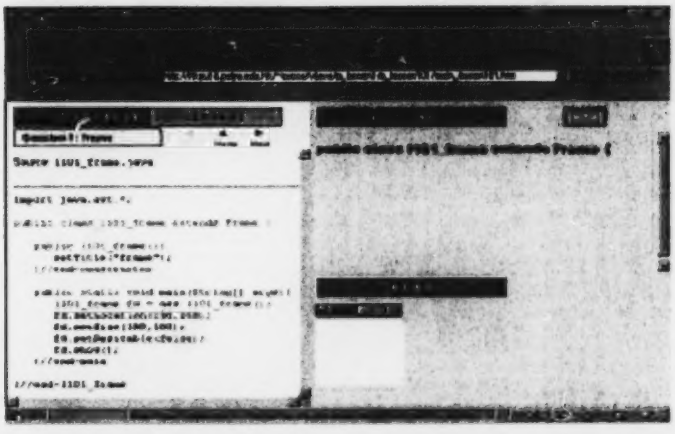

Figure 2. After the line being selected from the Code Book, Dictionary echoes the line

Figure 3 shows the change of color of the selected entity together with the corresponding pop-up explanation note. Because the current session is built from the previous section(s), therefore those statements that appeared in the previous session(s) will not be equipped with the Dictionary facility. The reason behind this is that students should learn the previous session substantially before they attend the current session. In this connection, the Dictionary facility indirectly induces a side effect of enforcing students to understand the materials more wholeheartedly.

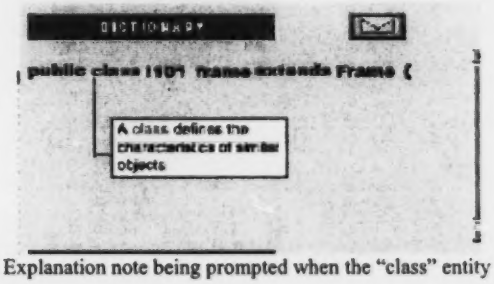

Figure 3. Explanation note being prompted when the "class" entity was selected

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3.3 Play

Play is the lower-right-hand section. It is simply the implementation of the Java coding displayed on the Code Book section. The visualization schemes [Hirakawa, Yoshimi, Tanaka and Ichikawa 1989] between data of the Code Book and visual objects in the Play will not be built in this version.

4 Conclusions

The construction phase and the testing phase of the Web-based Model of Learning Java has been completed in January 2000. A group of 59 students from the Higher Diploma in Information Systems program of our University has participated in this project. Prior to joining the project, students had attended a programming course in C. The project commenced on February 2000 and will run for a period of nine weeks. For each week, there will be a two-hour lecture and one hour tutorial. The continuous assessment will consist of two group assignments and one independent project. A formal survey will be conducted at the end of the course. The number of access of the Web site by students has been recorded more than 1,300 for a period of six weeks. More complete findings will be reported later.

Acknowledgments

The development of the Web-based Model of Learning Java is a funded project supported by the University. Grants Committee (Hong Kong). The authors would also like to express their sincere thanks to Mr. Julian Kwan for his kind support to the project.

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AWETS: An Automatic Web-Based English Testing System

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Test items are traditionally created by experts. While this approach has many advantages, it is laborious and time-consuming. Recent advance in corpus-based computational linguistics has shed new light on the feasibility of a computer-based language testing system capable of automatically generating items. This paper describes AWETS, an automatic web-based English testing system developed by the author's research team and used in his freshman English classes at National Taiwan University. AWETS automates test item generation, test delivery, scoring, and record keeping. It can generate random items for each testee in accordance with the input conditions of the test administrator. With AWETS, testers' jobs are reduced to inputting information such as a list of words and the time limit of each question. Besides being a useful tool for creating achievement tests in English vocabulary, AWETS can also generate proficiency tests based on a selected difficulty level without the need to input a word list. AWETS can be seen as a significant step toward future computer-based language testing system.

Keywords: **automatic generation of items, computer-based language testing, corpus-based computational linguistics, vocabulary testing**

1 Introduction

Test databank in current computer-based language testing systems is mostly created by human experts. This procedure is laborious and time-consuming. Moreover, since test databank is difficult to adapt, teachers using the systems have to spend a lot of time creating the tests for their own classes. To solve this problem, several researchers have suggested the feasibility of designing a tool to automatically generate items. For instance, [4] proposes creating a vocabulary test or exercise from a general corpus using a concordancer, and [5] suggests automatically generating CALL exercise from an electronic dictionary and a parsed corpus. Along the same line of research, we build AWETS, an automatic web-based English testing system that can greatly facilitate the creation of multiple choice vocabulary test. The system, designed with the central concern of adaptability, can generate multiple choice vocabulary test items in accordance with the conditions input by test administers. The system consists of three independent yet interrelated modules: the item generation module, the test delivery module, and the record keeping module.

2 The Item Generation Module

The system is developed based on a large collection of electronic texts and natural language processing tools such as a morphological analyzer and a part-of-speech tagger. The procedures of building the system are as follows.

1. Collection of a Text Database: We retrieve free electronic English texts from the internet primarily from Project Gutenburg and the Sinorama Magazine. Texts in Project Gutenburg are mainly literary works, while those in the Sinorama Magazine contain articles about the culture and events in Taiwan. To ensure that the retrieved texts are not too difficult for our learners, we only include works published after 1960.

The corpus size is about 0.2 million words.

2. Lemmatization: All the retrieved texts are processed by a morphological analyzer developed by University of Pennsylvania which changes regular and irregular inflections into their lemmas, i.e. basic forms (e.g. ran => run, happier => happy).
3. Frequency counts of lemmas: After lemmatization, frequency count of each lemma in the entire corpus is conducted.
4. Sorting of the frequency count of the lemmas in descending order:
5. Identification of the difficulty levels of each lemma: Three levels of difficulty are specified. They correspond to college entrance exams, TOEFL, and GRE. Each level has a range of adjustable values. At present, the range of these three values is stipulated as follows.

College Entrance Exam	Words which fall in the range of the most frequently occurring 3000 – 5000 lemmas
TOEFL	Words which fall in the range of the most frequently occurring 5001 – 7000 lemmas
GRE	Words which fall in the range of the most frequently occurring 7001 – 9000 lemmas

6. Tagging: Each text is processed by Eric Brill' s tagger which labels each word its part-of-speech information.
7. Indexing of each word: A database is created which records the documents and position in which a word occurs so that sentences containing a specified word can be retrieved in no time.
   Test administrators can choose the level of difficulty, the part-of-speech of words, as well as the number of questions to be tested. Once the choices are made, the system will randomly retrieve sentences which meet the input conditions via the index. A subroutine then converts the retrieved sentences into multiple choice questions. The distracters of the questions are chosen from words of the same difficulty level as the target word. Figure 1 is the user interface for inputting conditions. Figure 2 is the automatically generated test items.

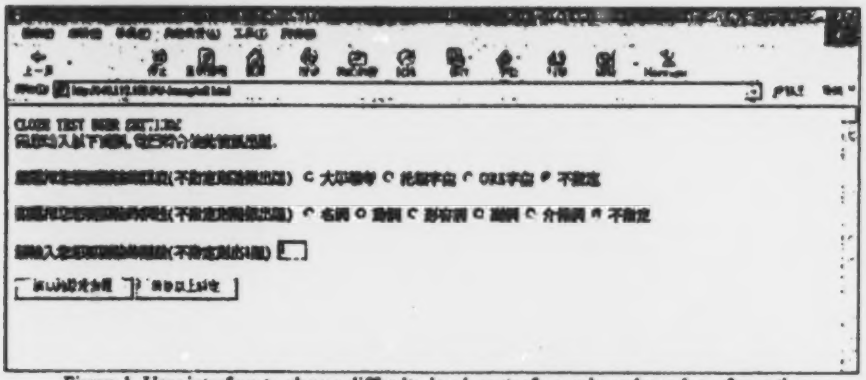

Figure 1. User interface to choose difficulty level, part-of-speech, and number of questions

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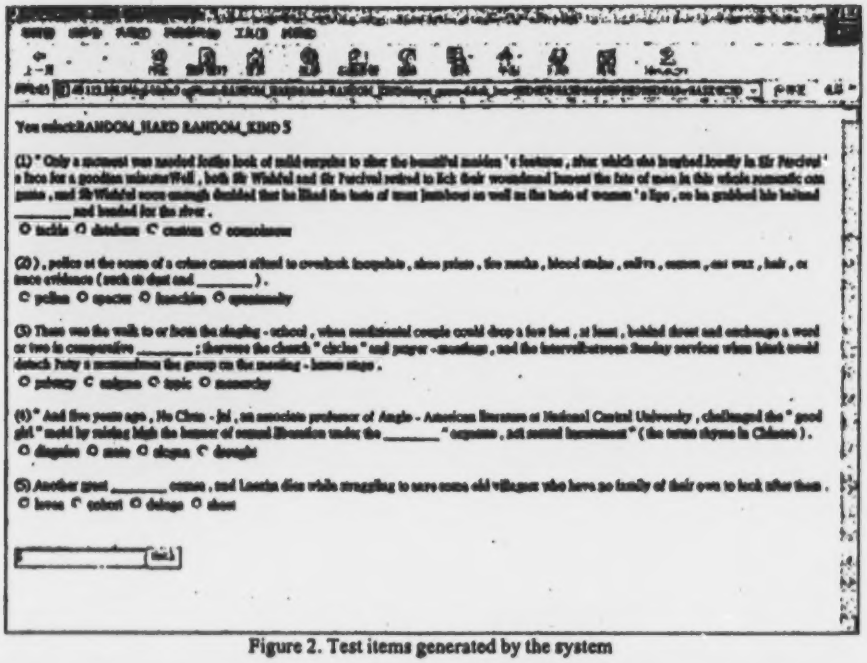

Figure 2. Test items generated by the system

As shown in Figure 2, the system is capable of generating individualized on-line vocabulary tests in the context of cloze tests based on the conditions input by a user. The system can thus be used as an excellent tool for self-paced vocabulary learning. If a learner wants to practice verbs at the TOEFL level, the system can create hundreds of such questions. As soon as he submits his answer, the system can check his answer and immediately present the correct answer to the user. Besides, if a test administer wants to change the difficulty level of the test, he can do it easily by changing the frequency range. To further facilitate the creation of vocabulary tests, the system also allows the test administer to decide which word should be tested. This is particularly useful for creating achievement tests. Once the tester inputs the words and the number of questions, the system can randomly generate multiple choice vocabulary tests in the context of cloze tests. Besides a corpus, AWETS also uses Wordnet, a lexical database developed at Princeton University, to generate items. It extracts the explanation of a lexical item and create multiple choice questions based on the item.

3 The Test Delivery Module

As described above, the item generation module can randomly create a specified number of questions in accordance with the input conditions by a test administer. To make test delivery more efficient, the test databank is created off-line. In other words, all the sentences meeting the input conditions are retrieved before the test starts. These sentences are converted into test items by a subroutine and then stored in the database. A subroutine then randomly retrieves a specified number of items from the databank and present them to the testees when the test starts. To ensure wide and unpredictable sampling, the subroutine is designed in such a way that no two tests are identical and no word will be tested twice in any test. The AWETS database also provides an interface (cf. Figure 3) for the test administer to input specification for the test. The interface allows the test administer to input the name of the test, the number of items, the time limit during which each question should be answered, and the number of times each testee can take the test. The test administer can further choose which classes and which words should be included in the test. After the test information is input by the test administer, testees proceed with the following procedures. They first input their user names and passwords. Before the real test begins, they are given 5 questions for practice. This procedure can help testees become familiar with the format of the questions. An interface and a test item such as Figure 4 is presented to the testees. As mentioned earlier, each question must be answered within a specified time limit. As soon as a question appears on the screen, the system begins to count down

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the time left. The randomized questions and the time limit make cheating in the examinations much more difficult. Without these two functions, students might try to find answers from the person who sit next to them or from an on-line dictionary. The countdown device might also achieve a beneficial backwash, because testees need to speed up reading the question in order to finish the questions within the time limit.

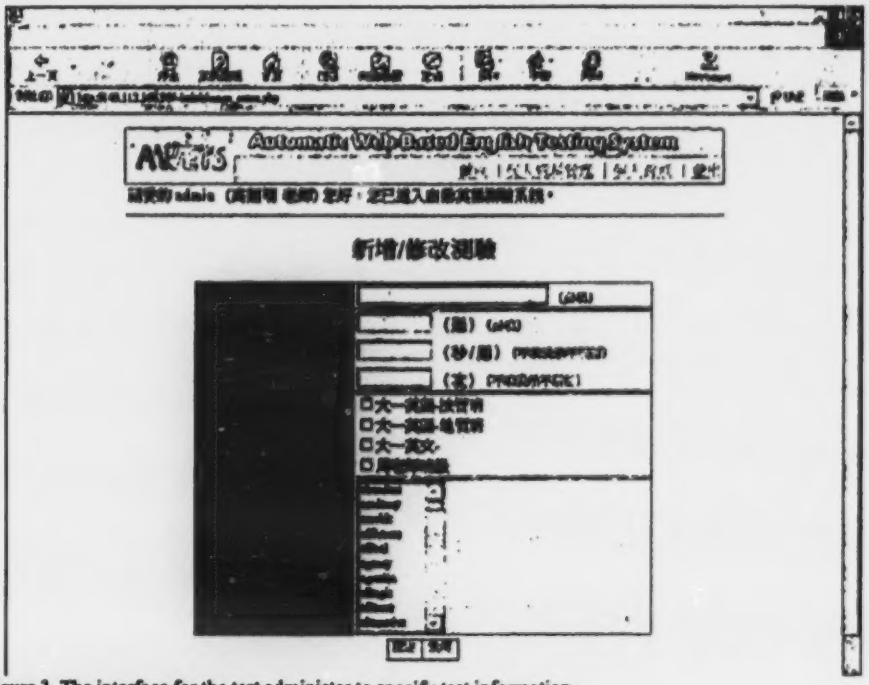

Figure 3. The interface for the test administer to specify test information

Figure 4. The testees' interface and a generated test item

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4 The Record Keeping Module

After each test, the system records the registration number, the name of the student, the test id number, the name of the test, as well as the student' s score in each test. The database component allows teachers to query a student' s record or the whole class's scores in an exam via the interface in figure 5.

Figure 5. The database interface for querying the whole class' s scores in a test

The database component greatly facilitates the calculation of validity and reliability. When testees are given more than one set of test items in a given test, the correlation of the scores can be easily computed. The system also records all the questions and testees' responses. These data can be used to analyze testees' test-taking strategies. With this function, item analysis is possible although no test candidates have identical tests.

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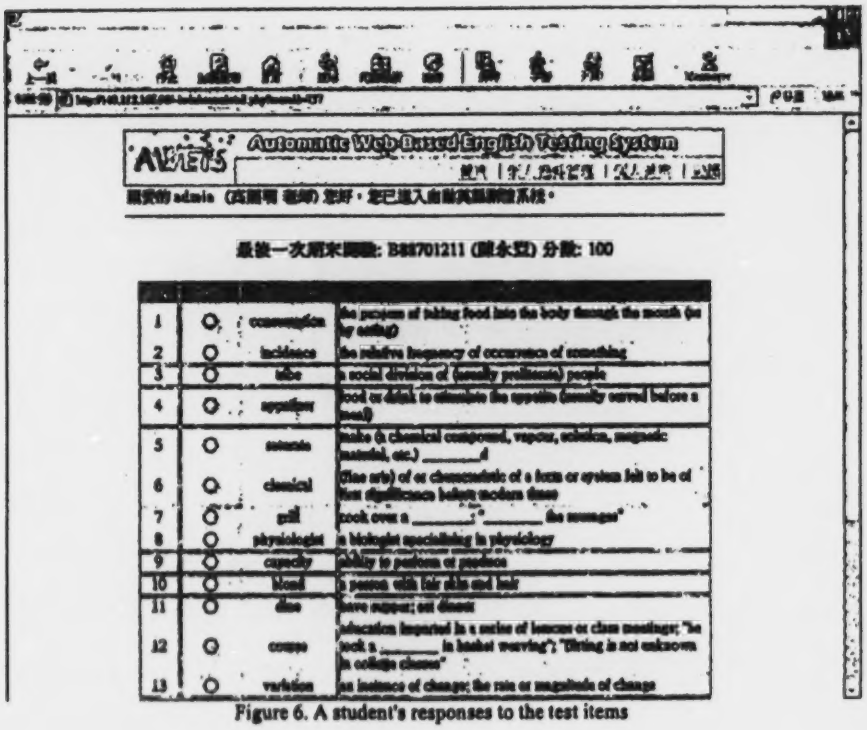

Figure 6. A student's responses to the test items

5 Some Problems of AWETS

Although AWETS performs relatively well, there are some limitations which prevent it from being a completely reliable testing instrument. First, the basic assumption that difficulty of words can be determined by frequency is challenged by some scholars, since there are some words common in everyday life but much less common in texts. Moreover, a word might have several meanings some of which are much more difficult than the others. The approach proposed in this paper cannot distinguish the difficulty of the different meanings of a word. Another question is whether there might be more than correct answer in generated test items. When AWETS automatically creates multiple choice questions, it randomly chooses distracters from the dictionary. Although the distracters rarely fit the context, it might happen that some of them are acceptable. Note that choosing distracters with different parts-of-speech from the target word does not solve the problem, because a word might be used in different parts-of-speech. It should also be admitted that although AWETS can create individualized tests, it lacks a rigid method to ensure equal difficulty for all testees. Another technical problem involved is that the part-of-speech tagging program and the program which identifies sentence boundary is not one hundred percent correct. This might result in undesirable test items. Even when sentence boundary is correctly identified, some sentences might not be appropriate in testing a learner when taken out of context. This is particularly true of short sentences. Long sentences, however, are not always unproblematic. In a vocabulary test, all the words in the sentence are meant to give the contextual clues except the target word. In other words, the target word should ideally be the most difficult word in the sentence. Consequently, if there is a word in the same sentence more difficult than the target word, the test item might not be appropriate. Questions like these all require more rigid methods than those adopted in current implementation of AWETS.

6 Conclusion and Future Research

In this paper, we introduce AWETS, a web-based system that can automatically create vocabulary tests and

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adapt items according to the conditions input by test administers. AWETS greatly facilitates the creation of vocabulary tests and has fully automated procedures for item generation, test delivery, scoring, and record keeping. At present, the validity and reliability of the automatically generated test items are being investigated. Future research will focus on solving the problems noted in section 5 by using sense-tagged texts and more rigid methods to identify difficulty of words.

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CALL with a Web-based Instructional System in Cooperative Learning Environments

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This study developed a Web-based instructional system for computer-assisted language learning (CALL) and examined the effects of ability of the student and group composition on achievement in reading, writing, and listening comprehension in Web-based foreign language learning in a cooperative environment. Forty-four students were randomly assigned to heterogeneous and homogeneous groups. The results of the analysis showed that group composition as well as student ability significantly exerted differential effects on the learning outcomes. The implications of these results for CALL in a Web-based cooperative environment were discussed

Keywords: **Cooperative Learning, Computer-Assisted Language Learning, Web-based Learning**

1 Introduction

1.1 Background of the Study

In recent years, the Internet has been increasingly utilized as an effective instructional tool for language learning, since the Web can become a multimedia-based content provider for both verbal and non-verbal elements of communication with versatility and interconnectedness (Clinch, 1999; Harasim et al., 1996; Khan, 1997; McManus, 1995; Owston, 1997; Ritchie & Hoffman, 1996). Recent studies have shown that the computer as an instructional medium also has the potential for promoting interaction and collaboration among students (e.g., Cates & Goodling, 1997; Cavalier & Klein, 1998; Chen, 1995; Johnson & Johnson, 1996). Computer-assisted language learning (CALL) using a Web-based instructional system can, hence, provide a learning environment that facilitates positive interdependence and collaborative efforts among students. The students work together in small groups at the computer; their efforts are directed toward mutual, academically and socially beneficial, goals. In general, extensive research on cooperative learning has shown profound and positive effects on a wide range of students' cognitive and social-affective outcomes (e.g., Johnson & Johnson, 1999; Johnson et al., 1993; Sharan, 1990; 1994; Slavin, 1995; 1996).

One of the key features that characterize cooperative learning settings and distinguish them from other learning settings is the increased opportunity for interaction among students of diverse ability, beliefs, and value systems in the learning process. Researchers have explored interaction as one of the mediating variables in the relationship between cooperative learning and social and academic gains (Hettinger, 1995; Huang, 1995; Sharan, 1990; Webb, 1989). Hence, in a cooperative learning environment, students are typically grouped heterogeneously. The rationale for heterogeneous grouping is based on the assumption that students can encounter wider diversity in heterogeneous groups than in homogeneous groups. Of particular interest in this study are the ability of the student and group composition. Although research indicates that both high- and low-ability students gain social benefits by working in heterogeneous groups, the cognitive effects of ability grouping, heterogeneous or homogeneous, have been inconclusive (e.g., Cavalier & Klein, 1998; Huang, 1995; Mevarech et al., 1991; Webb, 1989; Webb & Lewis, 1988).

1.2 The Purpose of the Study

The purpose of this study was to examine the effects of student ability and the influence of heterogeneous and homogeneous group composition on achievement in reading, writing, and listening comprehension in computer-assisted foreign language learning with a Web-based instructional system in a cooperative learning environment. The achievement in reading, writing, and listening comprehension of high- and low-ability students were compared in heterogeneous and homogeneous groups featuring individual and group accountability.

2 Method

2.1 Subjects

The subjects were 44 undergraduate students enrolled in a required one-semester foreign language course at a university in a metropolitan city in Korea. All the subjects had some previous experience with computers (e.g., word processing, Internet, telecommunications, games, and/or programming). All students had taken English as a first foreign language and French, German, Chinese, or Japanese as a second foreign language in middle and high schools

2.2 A Web-based Instructional System

For the purpose of this study, a Web-based instructional system was designed and developed for French language learning. This instructional system appears to be one of the first Web-based instructional systems for computer-assisted French language learning in Korea. The instructional system was designed to be adaptive to individual learning situations on a non real-time basis. Students can navigate the hyperlinked multimedia contents without a pre-ordered learning schedule. Through their exploration and navigation, thus, they can design their own instruction. The contents of the instructional system are divided into two levels: beginning and advanced. Each level consists of 15 coherent but independent lessons. As shown in Figure 1, each lesson is composed of six sections: reading, writing, listening, speaking, grammar, and games.

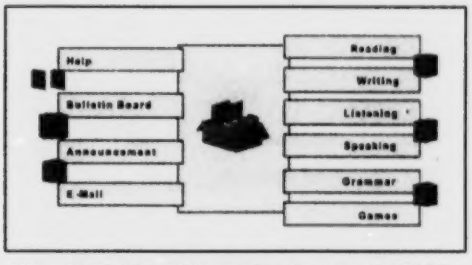

Figure1. Web-based instructional system for CALL

The reading section shows paragraphs in a variety of styles and includes interpretations and in-depth explanations regarding morphological, lexical, syntactical and semantic-pragmatic rules and expressions used in each sentence. The writing section enables students to gain pragmatic competence in their writing skills. It provides questions related to context-based composition. The listening section presents simple expressions with immediate text feedback to improve students' listening comprehension. The speaking section is designed with an emphasis on conversational practice, based on given situations presented as a picture. Concerning the grammatical rules of the previously presented sentences, the grammar section provides charts, pictures, and examples as well as explanations about those points. The game section is an additional unit designed to motivate students through games, songs, or puzzles, which may not deal with the lesson directly.

The instructional system also includes the interactive facilities: help, bulletin board, announcements, and e-mail. The help component includes general instructions regarding the system. The bulletin board deals with management-related interactions such as a school calender and logistics. The announcements show FAQ's (Frequently Asked Questions) on subject materials or technical problems. The e-mail allows for individual communications. These interaction facilities were designed to provide various types of asynchronous communications among three different user groups: teachers or tutors, students, and system administrators.

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In designing and developing the user interface of the instructional system, a special emphasis was placed on user-friendliness and efficiency. A simple, intuitive design with a text -based menu, rather than a complicated design, was preferred. In addition, the instructional system utilizes well-designed TrueType fonts, which support Unicodes such as 'Lucida Sans Unicode,' 'Berdana,' and 'Times New Roman.' The basic color of the instructional system was carefully selected based on color-effectiveness studies (Moore, 1996; Pett & Wilson, 1996; Weinman & Heavin, 1996). Given current access speed to the Internet via modems or LANs (Local Area Networks) in schools, a minimum level of animation was used in order not to interfere with students' concentration level in the learning process (Jeong & Yoon, 1998). For consistent and systematic delivery of information, any subsequent hyperlinked information is presented on the same page. To this end, the interface was developed using Active Server Page (Hillier & Mezick, 1998) and Dynamic-HTML (HyperText Markup Language) (Homer, 1997).

2.3 Procedure

Before the study began, students were asked to complete a background survey, which was given in order to assess students' previous experience with computers and language learning and to provide a better description of the subjects. A pretest was administered to all students to identify those with high or low ability. Stratified random sampling was used to assign students to heterogeneous and homogeneous ability groups. Heterogeneous ability groups contained one high-ability student and one low-ability student. Homogeneous ability groups contained two high-ability students or two low-ability students. Students were unaware of the ability composition of the group. Students then received an overview of the Web-based instructional system and instruction for cooperative work. They were instructed to work cooperatively as a group on the task, to help each other learn, and to make group decisions on the course of their actions in the learning process. Students were not assigned specific roles within a group, nor were they allowed to divide the work. Students worked for 50 minutes each day, 2 days each week, for 15 weeks, a total of 30 instructional sessions for one semester.

2.4 Research Design and Data Analysis

The study employed a 2 x 2 factorial design. The between-subjects factors included Ability (high, low) and Group Composition (heterogeneous, homogeneous). The within-subjects factors included Achievement Scores of Reading, Writing, and Listening Comprehension. The analysis of variance (ANOVA) was performed to determine the interaction effects as well as the main effects of ability and group composition on achievement in reading, writing, and listening comprehension. The analysis of covariance (ANCOVA) was also conducted, with students' previous experience with computers and the pretest results serving as the covariates. The level of significance was set at .05 in this study.

3 Results

The means and standard deviations for achievement in reading, writing, and listening comprehension are presented in Table 1. The results of the analysis of variance for achievement scores by ability and group composition are shown in Table 2.[1]

[1] It should be noted that students' previous experience with computers and the pretest results did not significantly correlate with the achievement scores. The results of ANCOVA rarely differed. Hence, for the purpose of clarity, the results of ANOVA are presented in this section.

Table1. Means and Standard Deviations of the Achievement Scores by Ability and Group Composition

		Reading	Writing	Listening	Total
Ability					
High	M	8.39	8.22	5.43	22.04
	SD	1.23	2.13	2.43	4.76
Low	M	7.38	7.00	4.43	18.81
	SD	1.94	2.55	2.06	5.54
Group Composition					
Heterogeneous	M	8.64	8.27	5.18	22.09
	SD	1.33	2.19	2.42	5.26
Homogeneous	M	7.18	7.00	4.73	18.91
	SD	1.68	2.47	2.19	5.04
Total	M	7.91	7.64	4.95	20.50
	SD	1.67	2.39	2.29	5.34

3.1 Reading

Significant main effects were found for Ability, F (1, 40) = 7.208, $p < .05$, and for Group Composition, F (1, 40) = 14.029, $p < .05$, and significant interaction effects were also found for Ability and Group Composition, F (1, 40) = 7.268, $p < .05$. These results indicate that student ability and group composition exerted differential effects on achievement in the reading posttest, as shown in Tables 1 and 2. High- and low-ability students tended to achieve differentially across the groups of different composition on the reading posttest. The students in heterogeneous groups scored higher than did those in homogeneous groups. This pattern is more noticeable among low-ability students than high-ability students.

3.2 Writing

As shown in Table 2, there were significant main effects for Group Composition, F (1, 40) = 4.401, $p < .05$, and significant interaction effects for Ability and Group Composition, F (1, 40) = 3.759, $p < .05$. Yet, main effects for Ability were not statistically significant. Both high-ability and low-ability students working in heterogeneous groups tended to score higher on the writing posttest than did those working in homogeneous groups. These results indicate that the achievement of high-ability and low-ability students was dependent on the group composition in which they were working.

3.3 Listening Comprehension

No significant effects were found for Ability or Group Composition or for the interaction between Ability and Group Composition. The results indicate that the differences between the posttest means were not statistically significant, probably due to the relatively large standard deviations, as shown in Table 1.

Table 2. ANOVA Results for the Achievement Scores by Ability and Group Composition

	Source of Variation	Sum of Squares	DF	Mean Squares	F	*P*
Reading	Ability	12.750	1	12.750	7.208	.011
	Group Composition	24.817	1	24.817	14.029	.001
	Interactions	12.856	1	12.856	7.268	.010
Writing	Ability	17.892	1	17.892	3.719	.056
	Group Composition	19.442	1	19.442	4.401	.046
	Interactions	18.041	1	18.041	3.759	.050
Listening	Ability	11.600	1	11.600	2.316	.136
	Group Composition	2.759	1	2.759	0.551	.462
	Interactions	11.697	1	11.697	2.335	.134
Total	Ability	125.586	1	125.586	5.818	.021
	Group Composition	122.144	1	22.144	5.659	.022
	Interactions	126.632	1	26.632	5.867	.020

4 Conclusion

This study examined the effects of student ability and group composition on achievement in reading, writing, and listening comprehension in computer-assisted foreign language learning with a Web-based instructional system in a cooperative learning environment. The results of the analysis of variance indicate that group composition as well as student ability significantly exerted differential effects on the learning outcomes. Both high-ability and low-ability students working in heterogeneous groups showed higher achievement than did those working in homogeneous groups. These results corroborate and lend further support to the findings of the previous studies, that heterogeneous group composition benefits students of both high ability and low ability (Larson et al., 1984, Webb, 1982a; 1982b; Yager, 1986). The cooperative learning methods, in non-computer settings, often call for students to be grouped heterogeneously by ability (e.g., Sharan, 1994; Slavin, 1995). The findings of this study suggest that ability grouping can also be utilized as an effective and practical method in Web-based instructional settings

Suggestions for future research should be noted. First, a comparative study of group learning with individualized learning in Web-based instructional settings may be worth further investigation. Second, this study employed pairs; the findings may not apply to larger groups. Some research suggests the importance of group size as well as group composition in computer-based cooperative learning (Guntermann & Tovar, 1987). Finally, this study has focused on the product of group learning. Future research should also analyze the intra-group dynamics among students in the learning process.

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CoCoAJ: Supporting Online Correction of Hypermedia Documents for CALL

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This paper describes an online markup-based composition learning environment system called **CoCoAJ** (Communicative Collection Assisting System for Java). It allows students and teachers to exchange marked-up documents via Internet, and its environment is very similar to a real world one in which people use pen and paper. In order to record and exchange corrected compositions with marks and comments, this paper proposes XCCML (eXtensible Communicative Correction Mark-up Language), that is based on XML (eXtensible Mark-up Language). XCCML facilitates teachers to analyze and reuse the marked-up documents for the instruction.

Keywords: **Computer assisted language learning, Collaborative writing, XML, Online document correction, Hypermedia.**

1 Introduction

Recently, teacher-centered instructional approaches in traditional writing classrooms are replaced with more active and learner-centered learning approaches with collaborative writing tools[2]. These tools can (1) change the way students and teachers interact; (2) enhance collaborative learning opportunities; (3) facilitate class discussion; and (4) move writing from solitary to more active and social learning. Writing compositions includes various sub-processes such as planning, transcribing, and revising, which do not need to occur in any fixed order [19]. In particular, the review process assisted with computer-based writing tools, has recently received much interest (see as examples [4, 9]).

Many researchers developed online markup systems employing some markup models. However, it is very difficult to analyze and reuse the marked documents that are collected through the writing classroom because the documents do not have a common structure. Therefore, it is necessary to define the generalized format for encoding and exchanging the marked-up documents in order that online markup systems are used easily and widely.

CoCoA (Communicative Correction Assistant system) has been developed for supporting foreigners and teachers to exchange marked-up documents by e-mail [14]. Its environment is very similar to a real one in which people use paper and pen. CoCoA allows teachers not only to correct the compositions sent from foreigners by E-mail, but also foreigners to see where and why the teacher had corrected them. CoCoA improves the opportunities that foreigners have for writing Japanese compositions and for receiving instructions from teachers. **CCML** (Communicative Correction Mark-up Language) [15] has also been proposed for the representation of marked-up documents, which is based on **SGML** (Standard Generalized Mark-up Language) [8]. With CCML, teachers and students can exchange marked-up documents via e-mail [16, 17]. In the experimental use of CoCoA, most of users commented that CoCoA was easy for them to understand the mistakes in documents because of the use of marks, and that the optional view of the original, marked or revised text was very useful. However, CoCoA cannot show users a hypermedia document including figures, tables, movies and links because it deals with only text.

This paper tackles how to correct hypermedia documents by the extension of CoCoA. This paper proposes **CoCoAJ** (CoCoA for Java) to do so. Also this paper describes **XCCML** (eXtensible CCML) for correcting

hypermedia documents, that are based on XML (eXtensible Markup Language). XCCML is combined CCML with HTML (Hyper Text Markup Language) that can represent hypermedia documents including pictures, movies, audios and so on.

We have been investigating technological support for Japanese language learning among overseas students. For example, CAI systems called Kanji Laboratory [7], JUGAME [23], GRACILE[23] and JULLIET[1] were developed to support Japanese language learning. However, an on-line mark-up supporting system for Japanese language learning has not yet been proposed. Usually, in a Japanese writing classroom, teachers have to individually review learners' documents using pen and paper[18]. It takes a lot of time for teachers to do this. Therefore, we have implemented CoCoA for writing Japanese composition.

2 Online markup models

There are some editing systems that support teachers to review and correct the students' drafts with online mark-up. Farkas & Poltrock [5] classified the mark-up models as followings:

(1) *Silent editing model*: This is the simplest model and it requires no special techniques. However, it is very difficult for the author to check the editor's work. This model is destructive because the editor cannot readily recover the original words once he/she has changed it.

(2) *Comment model*: This model employs pop-up notes, temporary footnotes, hidden text, and special symbols placed within the text. This model can work for special groups and ad-hoc situations. A system called XyWrite[10] was proposed with this model.

(3) *Edit trace model*: In this model, the editor works in the manner of an author, deleting, adding, and moving text as usual. The computer can compare the editor's new version with the original text, and allows the author to view the draft that contains the editor's changes. This model is apt to encourage heavier editing and less regard for the author's original text. Microsoft Word accepts this model.

(4) *Traditional mark-up model*: This adapts the traditional paper mark-up model to the computer screen. The symbols are both familiar and intuitive for editors and authors; for example, deletion, insertion, and move. For instance, Red Pencil allows the editor to apply a complete set of traditional editing symbols directly to a document. The editor uses "digital ink" to mark a traditional editing symbol along with the words. Moreover, MATE[6] allows the editors to use both digital ink and voice command toward pen and voice computing. In this model, authors and editors can interpret the editor's markings much more readily than in the edit trace model.

There are many systems that employ traditional mark-up which allows multiple users to mark-up an electronic document as if they were marking up a printed copy of the document. However, such systems do not globally come into practical and wide use in composition writing classes because of their special format. Moreover, it is very difficult to analyze and reuse the marked documents because the marked documents are unstructured. Therefore, the system should provide a generalized and structured format for encoding and interchanging marked-up documents via the Internet.

3 XCCML

Based on the experimental results, we propose XCCML for exchanging marked-up documents. XCCML is an application of XML, and it supplies a formal notation for the definition of generalized mark-up languages. XML is a device- and system-independent method of representing texts in electronic form. That is to say, XML is a set of mark-up conventions used together for encoding texts. A mark-up language must specify what mark-up is allowed, what mark-up is required, how mark-up is to be distinguished from text and what the mark-up means.

3.1 Features of XCCML

The main characteristics of XCCML are:

(1) Based on the experiment, XCCML presents six marks and annotation XCCML tags.

(2) The marks have three degrees of importance levels against respective corrections.

(3) The original text is generated through removing all the XCCML tags.

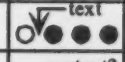
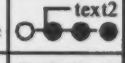
(4) The revised text is derived from the XCCML document.

(5) Because XCCML documents are text-formatted, it is easy to send them by e-mail.
(6) CCML documents easily make up full-text databases.
Needless to say, XCCML inherits its features from XML.

3.2 XCCML structure

As shown in table 1, XCCML documents consist of three parts: header, body and close. "Header" represents additional information about the document. For instance, "next" tag denotes the next version of the document. The marks for review are shown in the "Body" as XCCML tags. "Close" shows the editor's comments. In one sentence, "insert," "replace" and "delete" marks were used, while "join," "separate" and "move" marks were used over two sentences. The part between the start tag and the end tag denotes the learner's mistakes. The "string" attribute represents the revised part of the document.

Table 1: Marks and XCCML tags.

Correction	Mark	Tag
1. Insert		<Insert string="text"/>
2. Replace		<Replace string="text2"> text </Replace>
3. Delete		<Delete> text </Delete>
4. Separate		<Separate/>
5. Join		<Join/>
6. Move		<Movefrom refid="id"/> <Moveto id="id"> text </Moveto>

(1) Root tags

Tag name	Explanation	Attribute	Attribute's contents	End tag
XCCML	Beginning of XCCML tag	Version	Version number	</XCCML>
Head	Header information	None		</Head>
Body	Corrected document	None		</Body>
Close	Overall comments	None		</Close>

(2) Tags in header section

Tag name	Explanation	Attribute	Attribute's contents	End tag
Title	Title of the document	String	Title name	None
Editor	People who corrected the document	Name	Name of the editor	None
		Email	Email address	
Author	People who write the original document	Name	Name of the author	None
		Email	Email address	

(3) Tags in body section

Tag name	Explanation	Attribute	Attribute's contents	End tag
Insert	Insert words	String	Inserted words	</Insert>
		Level	Level of importance	
		Comment	Comment for the correction	
Replace	Change words	String	Corrected words	</Replace>
		Level	Level of importance	
		Comment	Comment for the correction	
Delete	Delete words	Level	Level of importance	None
		Comment	Comment for the correction	
Separate	Separate a paragraph	Level	Level of importance	None

		Comment	Comment for the correction	
Join	Join paragraphs	Level	Level of importance	None
		Comment	Comment for the correction	
Moveto	Moved position from the original spot	Fromid	ID	None
		Comment	Comment for the correction	
Movefrom	Original position of the words	Toid	ID	</Movefrom>
		Level	Level of importance	
Annotate	Comment for the correction	String	Annotation contents	None
		Level	Level of importance	

(4) Tags in close section

Tag name	Explanation	Attribute	Attribute's contents	End tag
Comment	Overall comment	None	None	Necessary

3.3 Level of marks

We found that the marks do not have the same level of importance. We identify corrections on the following levels:

(1) Weak correction: The learner does not need to revise the document.
(2) Normal correction: The learner should correct the document.
(3) Strong correction: The learner must correct the document.

The strong corrections denote the important part of marks to be revised in the document. Using the importance level that the teacher had entered, the system provides the learner with the marks he/she wants to see. Therefore, the learner can avoid information overload from the reviewed documents. Every tag in table 1 has an attribute "level" that a teacher gives a number from one to three. Its default is two as normal correction.

3.4 Level of annotations

It is very important for a teacher to annotate the marked text for instruction in composition. For example, PREP Editor [12] is a word processor that allows writers and reviewers to create electronic margins, or columns, in which they can write and communicate through their annotations. We identify the following different kinds of annotations:

(1) Explanation: This is used for explaining the reason of a correction.
(2) Question: This is used for asking the learner a question; e.g., what do you want to write?
(3) Comment: This shows the educational view of the teacher with respect to the document.

4 CoCoAJ

CoCoAJ consists of CoCoAJ-Editor and CoCoAJ-Viewer. A teacher corrects the document of overseas students with CoCoAJ-Editor and the system saves the marked document in XCCML format. CoCoAJ-Viewer interprets the XCCML document, and shows the learner the marked document.

4.1 Learning processes using CoCoAJ

By using CoCoAJ, a learner receives instruction about a Japanese composition from a teacher with the following processes:

(1) The learner writes an original text with his/her familiar editor.
(2) The learner sends the document to his/her teacher with his/her own e-mail tool.
(3) CoCoAJ-Editor makes the document double-spaced. The teacher corrects the document with online marks and annotations. Then, the system allows the teacher to set the importance level to the marks in the document.
(4) After CoCoAJ-Editor saves the marked text as a XCCML document, the teacher sends it to the learner by e-mail.

(5) CoCoAJ-Viewer provides the learner with the marked text after interpreting the XCCML docum the system allows the learner to select the importance level to see the important part of the mar
(6) CoCoAJ-Viewer automatically generates both the original text and the revised one from the document. After editing the revised text, the learner can send it again to the teacher and continu the text.
(7) CoCoAJ maintains the version of the document, if the learner wants to revise the same docume

4.2 System configuration

Figure 1 depicts the learning environment of CoCoAJ.

(1) XCCML parser: This module analyzes XCCML documents using the XCCML parser after read through the file management module. Then, it provides the results of correction according to the importance of marks.
(2) Correction module: This module inserts XCCML tags into the learner's document, accordin revision of the teacher. After saving the marked text, the teacher sends it by e-mail to the learner
(3) Original text display module: This module generates the original text from the XCCML docu removing all the XCCML tags.
(4) Revised text display module: This module generates the revised text by applying XCCML tags.
(5) File management module: This module manages the versions of the documents. When the learn the teacher the revised document, the system creates a new XCCML document, inserts the "next" the old XCCML document, and also enters the "previous" tag into the new XCCML document.

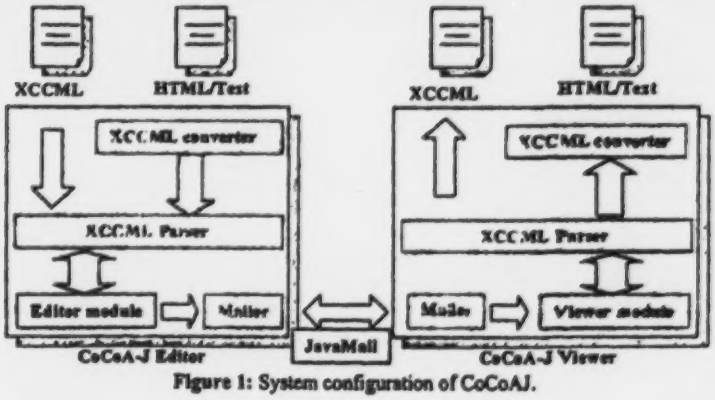


Figure 1: System configuration of CoCoAJ.

4.3 User interface

Figure 2 shows the screen snapshot of CoCoAJ-Editor. First, the learner writes a Japanese composition word processor and saves the document as HTML format. After that, the learner sends the document teacher by e-mail. By selecting a mark from the mark palette shown in the upper window, the teacher can the document. Moreover, the teacher can annotate the document using the annotation palette, and he/s classify the marks according to the level of importance. The user can see the correcting document at the le in the window and "*" means the user inserted the comment. The user can see the comments for the cor at the right side in the window. In this figure, the teacher substitutes "allow" with "allows" and gives a co "*2". Also the teacher can see the original document and revised one by selecting window tag. After savi marked document as a XCCML (see appendix A), the teacher can send it to the student by e-mail. CoCoAJ-Viewer, the learner obtains the same marked text that the teacher revised. By selecting the le importance, CoCoAJ-Viewer provides only the marks over the level. The learner can reply to the tea comments and collaboratively write a composition with the teacher.

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(5) Because XCCML documents are text-formatted, it is easy to send them by e-mail.
(6) CCML documents easily make up full-text databases.
Needless to say, XCCML inherits its features from XML.

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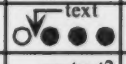
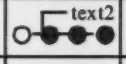
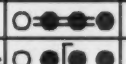
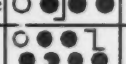
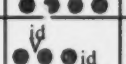
Table 1: Marks and XCCML tags.

Correction	Mark	Tag
1. Insert		<Insert string="text"/>
2. Replace		<Replace string="text2"> text </Replace>
3. Delete		<Delete> text </Delete>
4. Separate		<Separate/>
5. Join		<Join/>
6. Move		<Movefrom refid="id"/> <Moveto id="id"> text </Moveto>

(1) Root tags

Tag name	Explanation	Attribute	Attribute's contents	End tag
XCCML	Beginning of XCCML tag	Version	Version number	</XCCML>
Head	Header information	None		</Head>
Body	Corrected document	None		</Body>
Close	Overall comments	None		</Close>

(2) Tags in header section

Tag name	Explanation	Attribute	Attribute's contents	End tag
Title	Title of the document	String	Title name	None
Editor	People who corrected the document	Name	Name of the editor	None
		Email	Email address	
Author	People who write the original document	Name	Name of the author	None
		Email	Email address	

(3) Tags in body section

Tag name	Explanation	Attribute	Attribute's contents	End tag
Insert	Insert words	String	Inserted words	</Insert>
		Level	Level of importance	
		Comment	Comment for the correction	
Replace	Change words	String	Corrected words	</Replace>
		Level	Level of importance	
		Comment	Comment for the correction	
Delete	Delete words	Level	Level of importance	None
		Comment	Comment for the correction	
Separate	Separate a paragraph	Level	Level of importance	None

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		Comment	Comment for the correction	
Join	Join paragraphs	Level	Level of importance	None
		Comment	Comment for the correction	
Moveto	Moved position from the original spot	Fromid	ID	None
		Comment	Comment for the correction	
Movefrom	Original position of the words	Toid	ID	</Movefrom>
		Level	Level of importance	
Annotate	Comment for the correction	String	Annotation contents	None
		Level	Level of importance	

(4) Tags in close section

Tag name	Explanation	Attribute	Attribute's contents	End tag
Comment	Overall comment	None	None	Necessary

3.3 Level of marks

We found that the marks do not have the same level of importance. We identify corrections on the following levels:

(1) Weak correction: The learner does not need to revise the document.
(2) Normal correction: The learner should correct the document.
(3) Strong correction: The learner must correct the document.

The strong corrections denote the important part of marks to be revised in the document. Using the importance level that the teacher had entered, the system provides the learner with the marks he/she wants to see. Therefore, the learner can avoid information overload from the reviewed documents. Every tag in table 1 has an attribute "level" that a teacher gives a number from one to three. Its default is two as normal correction.

3.4 Level of annotations

It is very important for a teacher to annotate the marked text for instruction in composition. For example, PREP Editor [12] is a word processor that allows writers and reviewers to create electronic margins, or columns, in which they can write and communicate through their annotations. We identify the following different kinds of annotations:

(1) Explanation: This is used for explaining the reason of a correction.
(2) Question: This is used for asking the learner a question; e.g., what do you want to write?
(3) Comment: This shows the educational view of the teacher with respect to the document.

4 CoCoAJ

CoCoAJ consists of CoCoAJ-Editor and CoCoAJ-Viewer. A teacher corrects the document of overseas students with CoCoAJ-Editor and the system saves the marked document in XCCML format. CoCoAJ-Viewer interprets the XCCML document, and shows the learner the marked document.

4.1 Learning processes using CoCoAJ

By using CoCoAJ, a learner receives instruction about a Japanese composition from a teacher with the following processes:

(1) The learner writes an original text with his/her familiar editor.
(2) The learner sends the document to his/her teacher with his/her own e-mail tool.
(3) CoCoAJ-Editor makes the document double-spaced. The teacher corrects the document with online marks and annotations. Then, the system allows the teacher to set the importance level to the marks in the document.
(4) After CoCoAJ-Editor saves the marked text as a XCCML document, the teacher sends it to the learner by e-mail.

(5) CoCoAJ-Viewer provides the learner with the marked text after interpreting the XCCML document. Then, the system allows the learner to select the importance level to see the important part of the marked text.
(6) CoCoAJ-Viewer automatically generates both the original text and the revised one from the XCCML document. After editing the revised text, the learner can send it again to the teacher and continue refining the text.
(7) CoCoAJ maintains the version of the document, if the learner wants to revise the same document.

4.2 System configuration

Figure 1 depicts the learning environment of CoCoAJ.

(1) XCCML parser: This module analyzes XCCML documents using the XCCML parser after reading them through the file management module. Then, it provides the results of correction according to the level of importance of marks.
(2) Correction module: This module inserts XCCML tags into the learner's document, according to the revision of the teacher. After saving the marked text, the teacher sends it by e-mail to the learner.
(3) Original text display module: This module generates the original text from the XCCML document by removing all the XCCML tags.
(4) Revised text display module: This module generates the revised text by applying XCCML tags.
(5) File management module: This module manages the versions of the documents. When the learner sends the teacher the revised document, the system creates a new XCCML document, inserts the "next" tag into the old XCCML document, and also enters the "previous" tag into the new XCCML document.

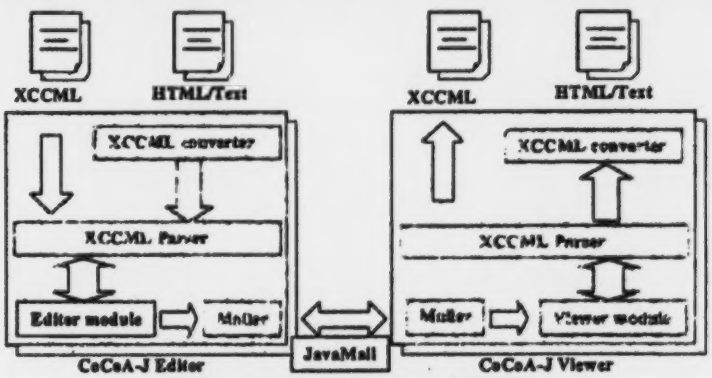

Figure 1: System configuration of CoCoAJ.

4.3 User interface

Figure 2 shows the screen snapshot of CoCoAJ-Editor. First, the learner writes a Japanese composition with a word processor and saves the document as HTML format. After that, the learner sends the document to the teacher by e-mail. By selecting a mark from the mark palette shown in the upper window, the teacher can revise the document. Moreover, the teacher can annotate the document using the annotation palette, and he/she can classify the marks according to the level of importance. The user can see the correcting document at the left side in the window and "*" means the user inserted the comment. The user can see the comments for the correction at the right side in the window. In this figure, the teacher substitutes "allow" with "allows" and gives a comment "*2". Also the teacher can see the original document and revised one by selecting window tag. After saving the marked document as a XCCML (see appendix A), the teacher can send it to the student by e-mail. Using CoCoAJ-Viewer, the learner obtains the same marked text that the teacher revised. By selecting the level of importance, CoCoAJ-Viewer provides only the marks over the level. The learner can reply to the teacher's comments and collaboratively write a composition with the teacher.

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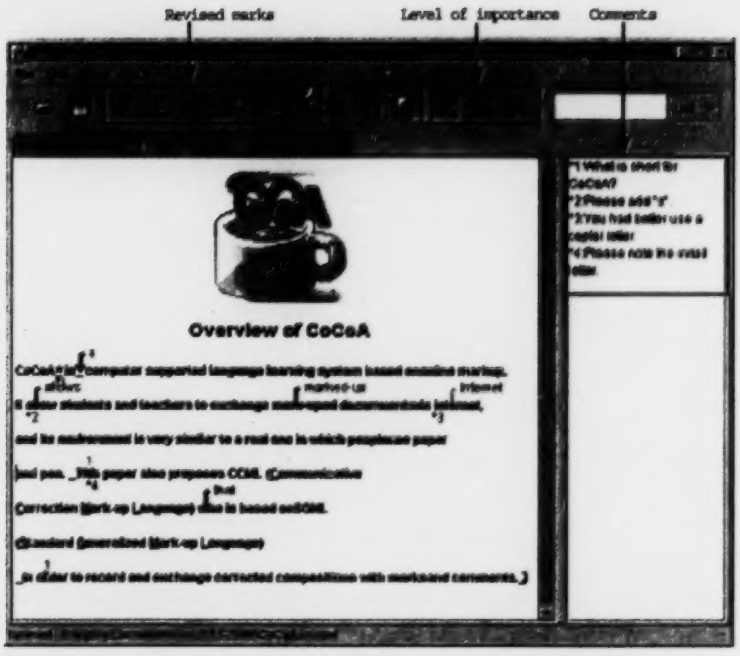

Figure 2: Screen snapshots of CoCoAJ-Editor.

5 Conclusions

This paper proposed a computer mediated language-learning system called CoCoAJ and XCCML for exchanging electronic marked-up documents. Now we are trying to propose XCCML to W3C (World Wide Web Consortium), and to show an XCCML document into Web browsers. After that, CoCoAJ will be able to be used for learning any language in an open-ended writing classroom. In our future research, we will investigate how to classify students' writing errors in their drafts, and how to assist a review process with AI technologies.

Acknowledgment

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Appendix A: **XCCML document in figure 4.**

```
<?xml version="1.0" encoding="Shift_JIS"?>
<!DOCTYPE XCCML SYSTEM "XCCML.dtd">
<XCCML>
<HEAD>
<Title string="Overview of CoCoA"/>
<Editor name="Hiroaki Ogata" email="ogata@is.tokushima-u.ac.jp"/>
<Author name="Yoshiaki Hada" email="hada@is.tokushima-u.ac.jp"/>
</HEAD>
<BODY>
<CENTER><IMG width="128" height="128"
src="image001.gif"/></CENTER><CENTER><H2>Overview of CoCoA</H2></CENTER> <H4>
CoCoA <Annotate level="3" comment="What is short for CoCoA?"/> is<Insert string="a" level="3"/>
computer supported language learning system based ononline markup.<BR/>
 It<Replace string="allows" level="3" comment="Please add &#34;s&#34;."> allow </Replace> students
and teachers to exchange<Replace string="marked-up" level="3"> mark-uped</Replace> document via
<Replace string="Internet" level="1" comment="You had better use a captal letter.">
internet</Replace>,<BR/> and its environment is very similar to a real one in which people use paper<BR/>
and pen. <MoveTo fromid="1" level="2" comment="Please note the initail letter."/>This paper also
proposes CCML (<U>C</U>ommunicative<BR/> <U>C</U>orrection <U>M</U>ark-up
<U>L</U>angua<Replace string="that" level="3">ge)</Replace> who is based on SGML<BR/>
 (<U>S</U>tandard <U>G</U>eneralized <U>M</U>ark-up <U>L</U>anguage)<BR/>
<MoveFrom toid="1" level="2">in order to record and exchange corrected compositions with marks and
comments.</MoveFrom></H4></BODY>
<CLOSE>
<Comment/></CLOSE>
</XCCML>
```

Computer-Mediated Language learning

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1 Introduction

The Web provides a new learning environment with a wealth of pedagogic possibilities. The colorful and visually engaging appearance, rich resources, online audio, video, and other interactive features, combine to make the Web an enormously valuable learning tool. Although it has been argued that web technology has the potential to provide a unique environment for teaching and learning, the psychological implications of its effects on learners' language learning has remained relatively unexplored. The current research does not present much empirical evidence to validate the instructional applications of web technology [1-6]. Furthermore, results of a meta-analytical study, Ayersman found that perceptions and attitudes toward technology are functionally important in promoting effective learning [7]. Therefore, more research needs to be conducted into learners' perceptions toward this new technology so specific guidelines for its successful implementation can be provided.

This study looked at learners' attitudes and perceptions as they conducted technology-augmented projects, and asked what were their affective attitudes and cognitive perceptions toward this tool. The study contributes to an understanding of language learning using the Web, and provides a basis for empirical studies of Taiwanese EFL learners performing real educational tasks with the Web. The insights gained in this small study will help EFL teachers design better learning environments with regard to classroom management, assessment and assignment.

2 Methodology

Participants

The 55 participants in this study were second year students , majoring in Applied English at a junior college. They had taken a 2-credit required course in Tourism English for two semesters.

Web-based Language Project

The goal of this project was to apply the language that the students had learned in an authentic context, to communicate, and to nurture students' global perspectives and information literacy. The project aimed to help students understand the Web with the ultimate goal of using it to create research projects about selected states in the U.S. Specifically, the objectives for the project were to: (1) provide students with background information about American culture, its separate states, cities, food, customs, people, history, travel information, etc. (2) provide students with an information-literate experience in web technology; (3) enhance students' discourse synthesis ability, namely, learning how to search, organize, and compose information for a research project. Students were asked to work on conducting a search of an assigned American state on the Web. Students could create their projects in whatever format they would like.

Instruments

A questionnaire was given to elicit relevant information on the participants' perception of, and attitudes towards, using the Web to complete their Web-based English projects. The first part of the survey pertained to background information. The second part consisted of 40 attitude and perception statements about learning experiences indicating levels of agreement or disagreement on a 5-point Likert-type scale with 5 standing for strong agreement. The Cronbach coefficient alpha of the survey was .87, suggesting the internal reliability to be quite acceptable. The third part included open-ended questions depicting their reflections about the project.

Data Collection and Analysis

After data collection, the quantitative and qualitative methods were performed. The qualitative analysis made from the student responses to the open-ended questions and the researcher' s observation, provided the opportunity to uncover deeper issues than might have been apparent in a quantitative study. Results from the factor analysis (principal axis factoring with varimax rotation) yielded six factors accounting for 64.11 percent of the variance. Following are the interpretations of each factor: cognitive disorientation, learning anxiety, perceived enhancement of language ability, perceived enhancement of cultural understanding, as well as the Web as a potentially useful search tool, and the overall perception of language learning on the Web.

3 Discussion and Conclusion

The study investigated second-year junior college students' attitudes and perceptions towards the web as an educational resource. Six main factors concerning the learners' perceptions were identified, including cognitive disorientation, learning anxiety, perceived enhancement of language ability, perceived enhancement of cultural understanding, as well as the Web as a potentially useful search tool, and the overall perception of language learning on the Web. The study showed that the reaction of students to technology-augmented assignments was mixed. Analysis of the survey revealed a generally positive attitude towards the project pertaining to the enhacement of cultural awarenss and overall language learning. A few negative responses were noted, as learners experienced varying degrees of disorientation and cognitive overload. In particular, those learners who do not adjust well to reading on the Web appear to have much learning anxiety and cognitive disorientation, and correspondingly, have a lower overall perception of language learning.

Some frustration with the challenges and difficulties in relation to computers and language were found. On the one hand, students' encountered technical difficulties in relation to the use of computers. The problems they encountered were; malfunctioning of the system, the periodic slowness of Internet connections, poor design of web documents, searching complications, time constraints and the inconvenience of being required to work on the project on campus. On the other hand, students commented on the challenges of reading, selecting, processing and evaluating information. For example, some learners had not developed effective searching strategies for locating appropriate information and, further made qualitative judgments as to the accuracy and reliability of specific information. Given the fact that interest is the impetus of learning, and method is the key to knowledge, teachers should inform learners of effective learning strategies and design diversified learning enviroments by providing intellectual, entertaining and interesting assignmets to enhance learners enjoyment. From this study, it could be concluded that computer-learning networks have the potential to empower students in well-designed learning environments. It is emphasized that the central computer-mediated learning experience in Language Studies can not be achieved by itself simply by the introduction of the learner to the web technology. Those learners who show reluctance towards technologically oriented projects need careful guidance and support from the pedagogical and technological applications of this self-directed curriculum. Therefore, providing scaffolding, both in using Internet applications and in orienting the learners to the task, is vital to the successful implementation and integration of technology into the curriculum.

It is undeniable that, being situated at the turn of 21 century as we are, developing the learner' s information literacy of the digital world is important. Learning to navigate and sift through huge amounts of information with speed and accuracy, as well as pursuing a critical level of understanding that goes well beyond literal or surface-level meaning, will prepare students for the challenges they will face as society delves deeper into the Information Age. The study calls for the learners' instrumental use of web technology to achieve language-specific goals. The project challenges learners to become both language and information literate in growing the following skills: awareness of global issues and concerns, the cross-cultural comparison, development of computer skills, enhancement of critical thinking and problem-solving skills, as well as specific communication skills such as arguing, persuading, or defending a particular point.

As the study shows, researching language instruction within a digital learning environment opens up a broader range of connections and meaning-making among learners. The present study is only a stepping stone on the way to examining learners' perceptions and attitudes toward the Web-based language project. Although this activity was conducted in a foreign language class, it could be adapted as an activity in a variety of disciplines to maximize the language dimension, such as social studies, global education, science, and cultural comparison [8]. The researcher believes that the possibilities for research in these powerful network environments will be conducive to broadening and refining language literacy.

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Designing for Interactivity

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In education, 'interactivity' is the catalyst that has transformed the traditional classroom setting into an active media environment. Yet the standards for interactivity within education are by no means clear. Educators and multimedia designers are confronted with many questions concerning the effectiveness of interactive courseware as a learning tool. In this paper, the authors draw on their experience of producing the interactive courseware package *Virtual Language University*, an interactive multimedia package for language learning that has over 3,500 interactive tasks. Specific topics in the paper include screen design, navigation, effective task writing, choices in the type of user feedback, scoring and testing. Attention is given to decision-making procedures that deepen understanding, promote interactivity and encourage self-direction.

Keywords: **interactivity, multimedia, courseware design**

1 Introduction

In education, interactivity has transformed the traditional classroom setting into an active media environment. As Laurel indicates, interactivity is a necessary component for learning to take place. Learners only learn how to learn when they are actively and continually involved in the learning process [13]. Yet the standards for interactivity within education today are by no means clear. Educators and multimedia designers are confronted with questions concerning the effectiveness of interactive courseware as a learning tool, such as: how multimedia can be successfully integrated into the classroom, what level of interaction should be included, and which programs are most suitable. As this new area of learning evolves, those involved in interactive learning are discovering that developing material according to a multimedia interface is simply not enough [25]; [26]; [5]; [3]. Courseware designers are being challenged like never before to produce material that deepens understanding, promotes interactivity and encourages self-direction.

In this paper, the authors draw on their experience of producing an interactive courseware package to discuss the primary areas involved in designing a multimedia program in a Higher Education institution. A review of multimedia production discourse will be used to connect the discussion to broader issues within educational technology and interactive learning. Attention will be given to the decision-making procedures that add to an enhanced level of interactivity within computer-assisted learning.

2 Development Environment

2.1 Virtual Language University (VLU)

Virtual Language University (VLU) is an interactive learning program developed at the City University of Hong Kong. The courseware consists of four CD-ROMs and aims to provide a self-directed learning tool for students and academic staff interested in improving their English skills. The two-year long project was

funded by the Teaching Development Grant of the University Grants Committee. The development team that was responsible for creating the program was an eclectic international mix, consisting of a project manager, three computer programmers, a graphic artist, two scriptwriters and several student helpers. This team worked closely during every stage of the production, including the conceptual phase of brain-storming and scriptwriting, and the production phase of computer programming, video recording, and graphic design. The program was completed after an extensive review and piloting process that took several months.

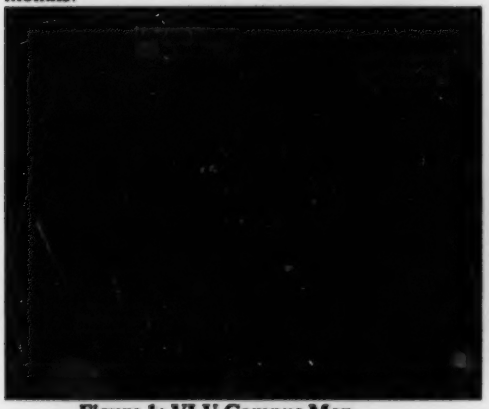

Figure 1: VLU Campus Map

Figure 2: VLU Lobby

Upon entering VLU, users are introduced to four units: Listening, Writing, Vocabulary and Grammar, metaphorically represented as four separate buildings in a virtual university campus (See Figure 1). The animated host, a friendly Dr. Einstein, provides first time users with a tour of the campus and explains how the program works. Once the users have selected a building (or unit) to work in, they are given a test and provided with feedback on weaknesses before being directed to the appropriate level: 1, 2, or 3, with 1 being the easiest (See Figure 2). For example, the Listening Unit consists of five multimedia lectures from University professors, which include video, graphics, sound and about 40 tasks per lecture. Users can control the forward, back and replay buttons of the lecture, and in this way monitor their own pace and approach in a "learner controlled" environment [5]. Within the Writing Unit, a video tutorial by an actual English teacher guides the students through complex writing structures, pausing for interactive tasks along the way. The other sections, Grammar and Vocabulary, provide ample practice for users to improve their proficiency in grammar usage and to expand their vocabulary. In total, there are over 3,500 interactive tasks in the program, all of which are programmed to give immediate or delayed feedback and a percentage score after each task. Users can also access their last two scores, as this information is automatically stored in the computer.

2.2 Project Development

Developing a multimedia product calls for a collaborative effort from various team members drawing from different backgrounds. The team usually includes a project manager (who is often the instructional designer), a subject-matter expert, scriptwriters, computer programmers, graphic artists, a videographer, an audiographer and administrative support [2]; [15]. The success of an interactive learning product depends very much on the ability of the team to work together; "As multimedia development demands the cooperation of many highly skilled and talented individuals, division of responsibilities, smooth communication, and strong commitment to the objectives of the project are essential to make a project successful" [15]. Depending on the size of the team, one person may take on several roles throughout the course of a project, or roles may overlap - as was the case for the production of VLU.

The project manager addresses the conceptualization stage [[9] and plans the instructional design. This involves a critical look at the educational needs, the interface design and a proposal for the delivery

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content. The project manager will identify the instructional goal of the program, which should define, in general, what the program intends to achieve [2]. At the same time, s/he will determine the learning characteristics important to the design, such as the level of instruction, language, age and culture of the end users. The project manager is also responsible for outlining the schedule for the project and may facilitate a liaison with external specialists. S/he coordinates the efforts of the team, encourages positive interpersonal communications, and ensures that team members stay on track and complete their part by specified deadlines [2]; [15].

The scriptwriter works with the project manager to develop the content and design of the final product. S/he is responsible for selecting appropriate media, writing tasks, creating storyboards as well as developing ideas for graphics. Together, the project manager and scriptwriter construct the skeleton for the project, which is then brought to life by the programmers and graphic artists. The early phase is probably the most important stage of the production - and, if done properly, can save hours of time in unnecessary programming and tedious revisions.

Once the programmers and graphic artists have the scripts in hand, they can proceed with the production phase. They may use a number of authoring programs, systems or languages to implement the suggestions of the scriptwriter and project manager [2]. The graphic artist designs the program's graphics and animation, working closely with the scriptwriter to ensure everyone is thinking in the same direction. The videographer collects and digitizes video and photo images and the audiographer records the necessary sound elements. In the case of VLU, university professors were videotaped professionally. Academic lectures were given on different topics, such as "Exploring the Internet", "Organizational Behavior" or the "Poetry of Cavafy". The scripts for the lectures were first written by the professors and then transformed into an interactive format by the scriptwriter and project manager. The professors also acted as the subject-experts of the team, providing specialized feedback during the piloting of the program.

2.3 Scriptwriting

The key to good interactive multi-media packages is the nature and level of interaction between the users and the application. The level of interactivity is directly related to the successful creation of appropriately placed tasks that range in nature and content. During the scriptwriting stage, decisions concerning the number and type of tasks, the style of feedback, the sequence of questions, the different levels of tasks and the type of scoring are made. The decisions should first be organized into an outline form to give a broader perspective and to ensure there is an appropriate distribution among all the categories. It is also important for scriptwriters to maintain consistency throughout the scripts with the use of identical terminology, predictable sequences and the same command language.

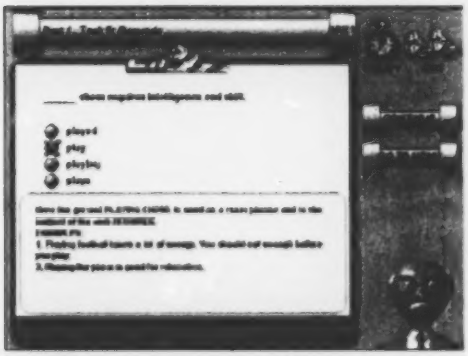

Figure 3: Grammar

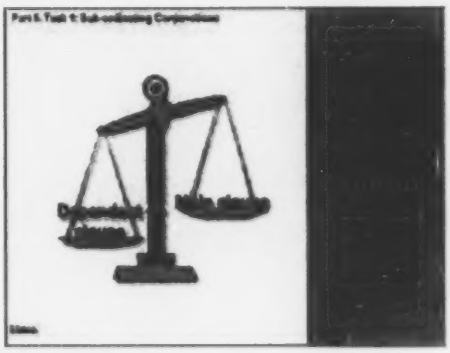

Figure 4: Writing

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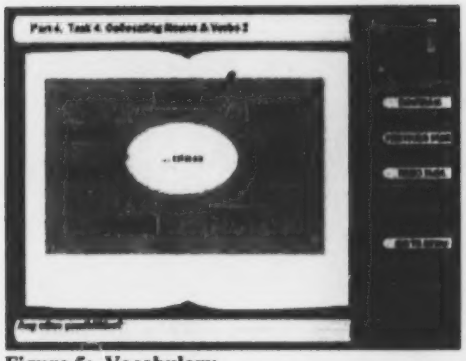

Figure 5: Vocabulary

Figure 6: Listening

In VLU, tasks were written according to the instructional aim of each of the four units (See Figures 3-6). The main types of tasks that were used include click, drag, notepad writing and multiple choice. Multiple choice and click are the easiest to construct, both for the scriptwriter and programmer, but should be combined with other task types to ensure maximum interactivity. Each task is designed according to the learning objective of the unit. For example, in the Listening Unit, tasks are diagnosed as vocabulary, main ideas, key words, summary, predictions or inferences. When choosing the frequency and placement of tasks, Orr, Golas & Yao [17] advise including an option for an interactive task every three of four screens, or once every minute. Yet designers should avoid a strict adherence to any formula for interactivity, as it depends entirely on the content, style and complexity of the material being presented. "You cannot gauge the amount of active involvement in a technology product by the number of mouse clicks, and ... similarly, one cannot assess learning by overall level of activity" [26].

The binary structure of the computer makes the process of task-writing an interesting and difficult endeavor. The scriptwriter is faced with the challenge of creating insightful, thought provoking tasks that elicit predictable, quantifiable responses. Where a teacher may be able to judge the validity of a multiple range of answers, a computer cannot. It is therefore up to the scriptwriter to predict all of the potential responses, a challenge especially for tasks that allow users to type responses in an open-ended format. During the piloting of VLU, for instance, it was observed that certain open-ended questions caused frustration among students who believed their answer to be correct - and if judged by a real-life teacher, may well have been. It is for this reason that questions with vague, complex or multiple responses must be constructed with great care.

How, then, can multimedia tasks be written without oversimplifying multifaceted and in-depth subject matter? This has been one of the leading criticisms of multimedia development as it expands to cover the more concept-based material within higher education. Users may get an unwarranted sense of having mastered a complex subject after correctly answering a complete set of computerized quizzes and close-ended questions [14]. One method of avoiding such a compartmentalization of information is allowing students to write down their own opinions on a profound subject matter using a computerized notepad. In VLU, this non-graded task is used to elicit predictions of what the lecture could entail, or personal opinions that the student may have. In this way, students are encouraged to contribute their own ideas and thus are able to build confidence in their analytical skills. The producers of the interactive multimedia package *Investigating Lake Iluka* argue that the notepad facilitates cognitive self-management by allowing students "to collect and manage information from a variety of different sources" [6]. This is substantiated by Laurillard [14], whose case study found that students appreciated "being forced, or perhaps enabled, to consider and develop their own analysis first, before seeing what the expert has written".

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3 Design Issues

3.1 Screen design

Interactive media places users in a one-on-one relationship with a program that can be as intimate, or more intimate than, a face-to-face exchange [22]. For that reason, it is the task of educational multimedia producers to transform that relationship into a successful learning experience. In a user-controlled environment that enables students to turn off the program whenever they want, screen design becomes essential to maintaining learner motivation. Effective screen design allows for maximum learning from the materials while providing the learner with appropriate control of the learning process [16]. This could be compared to the teacher's role at the beginning of a traditional classroom setting. An effective screen design sets the stage for meaningful 'deep learning' to take place and motivates the student to stay engaged. The signs of a poorly designed screen are cluttered displays, complex and tedious procedures, inadequate command languages, inconsistent sequences of action and insufficient informative feedback [20]. Such designs can lead to anxiety, poor performance and dissatisfaction with the program. Some researchers recommend limiting the amount of text on screen to three lines in order to prevent information overload [4]. Users are most effectively able to concentrate on the multimedia material when the screen is made user-friendly with consistent commands and positioning of buttons. The importance of the screen design is corroborated by a number of researchers [21], [1]; [23]; [8].

The choices for screen design are endless, but the two basic extremes are simple and complex. There are both advantages and disadvantages for either consideration. The primary advantage of keeping the screen 'simple and uncluttered' is that it is less likely that users will suffer from immediate sensory 'overload.' As Stemler points out, multimedia instruction packages can become "nightmares when designers try to dump anything and everything into a single program simply because the capability is there" [21]. Most researchers agree with this approach [17]; [18]; [19].

In many cases, a thoughtfully designed complex interface will hold the user's attention longer. The use of a metaphor is one way of integrating a number of complex features with a simple visual structure and provides users with a sense of place, familiarity and ease of use. Within VLU, the metaphor of campus buildings is employed to distinguish between the four sections of the program: Grammar, Listening, Vocabulary and Writing. This metaphor is also useful for selection of the three levels of difficulty within the program. After diagnosis, the users take an elevator to the appropriate level of the unit they are working in.

3.2 Navigation

Unlike passive approaches to education, in student-centered learning, users navigate the path of their own learning. Because of this, the navigation design of a program determines the level of interactivity users will experience. There is a delicate balance between giving enough sense of direction to avoid anxiety, without over-directing users. It is important for users to always know where they are going. Too much freedom may result in students reviewing material or completing tasks that are not relevant to their purpose. According to the findings of Laurillard, learners working on interactive media lacking a clear narrative structure will display learning behavior that is generally unfocused and inconclusive. Learner control, one of the key benefits of interactive media, thus becomes pedagogically disadvantageous if it results in mere absence of structure [14]. While the users should be provided with sufficient choice through hypermedia links, there needs to be a balance between jumping around and sticking to one task [5]. According to Wild and Quinn, the ideal combination is "scaffolded reflection", that is, navigation that encourages thinking without losing the focus of the instruction [24].

There are several possibilities for how users access materials: sequentially, semi-directed, free choice or through pathways. Each of these methods can be designed to have extreme linear order or extreme non-linear order where users have little or no chance of deviating from a predetermined sequence. Thus,

package possibilities can range from strict, prescribed, sequential learning to complete freedom of choice. An alternative is a semi-directed program, allowing for the possibility of choice within certain situations.

Users can be given the option of skipping ahead only when a task is finished or they can be allowed to skip ahead at any time. Common procedure is to have the exit function or menu function available to users at all times. This implies that the navigation has minimal travelling; that is, express pathways so users arrive at their desired destination as fast as possible with little or no redundancy. In contrast, users may not be given the option of skipping at all but can only exit when a particular task/topic/section/unit is finished. Kristof & Satran suggest that users should not have multiple paths to any particular location because this causes confusion [11].

In VLU, users can chose to skip ahead to sub-topics at any time, yet are required to select the Main Menu to do so. Thus, while students can jump around to any building or level, they automatically enter a linear sequence once they have chosen a particular lesson (unless they click on the Main Menu, which is available at all times). This is particularly true for the Grammar section, where skipping ahead may mean missing important grammatical rules and explanations. In this section, students choosing to skip ahead will hear a friendly reminder from the animated host: "You are not advised to go to this task at this stage". Users are then given the option of proceeding anyway, or returning to the previous section.

3.3 User Feedback

Within the interactive format, the educational value of a program is directly linked to the style and quality of user feedback. The users can receive either immediate or delayed feedback to responses or actions. Immediate feedback lets the users have only one attempt at providing correct information, or making a decision. Delayed feedback, in contrast, allows the users to have a longer learning experience, an experience which requires completion of one or more steps before the users receive any feedback.

Feedback can also range from: i) individualized feedback which is based upon individual choice and performance, ii) to a more general response which addresses content considerations, iii) to a type of scoring (percentage, grade, written comments). Personal feedback can be created to address users by name and either make suggestions or critique decisions made. In VLU, the computer greets users by name as they enter the program. Because most users tend to respond positively to being addressed individually, this is usually seen as a positive option [9].

3.4 Testing

Users can also be tested before, during, or after using a package. The test that precedes the work done in the package can be used as a diagnostic tool for the user. By diagnosing weaknesses or strengths, students can be directed to enter the program at an appropriate level of difficulty. Considerations on the nature of the test include whether or not the test should be timed, whether students should be able to choose the subject matter of the test and how long the test should be. The answer to these questions will depend upon the type of material being tested. Analytic material probably requires no time limit, whereas non-analytic material may need to be timed. A secondary consideration would be how many times a user can take a specific test. How often should tests in general be given? Once per unit? One test per section or per topic?

If testing is used, diagnosis will be more reliable if several tests have been taken; therefore, a bank of tests is useful. It follows then that each test must accurately assess the skills being tested and all tests must be equal in difficulty. The generation of tests can be accomplished by having a single bank of questions with the computer randomly selecting the questions. This will ensure that users do not duplicate test materials.

Testing within VLU is an option provided to users once they have entered one of the campus buildings. The test length varies according to each section, but averages about 15 minutes per unit. For example, upon entering the Listening Test area, users are presented with a pop-up menu that asks them to select a test in

their area of interest: Environment, English, Politics and Business or Social Issues. In this way, students are able to control their learning experience and are not penalized for a lack of knowledge in a particular area.

3.5 Scoring

Another question designers will need to address is what kind of report users will receive after completing a test or set of tasks. Does the program require written comments, percentage grades, or is a simple pass/fail more appropriate? Reporting can be automatic after each task, or the report can be accessed upon request. One extreme is for there to be no access to scores until the entire unit/section/package is completed; the other is for automatic reporting to occur whenever a task is completed. The feedback or report can be a numerical or graphic representation. There can be results posted on the screen, or they can be printed, or even saved to a disk. Another design possibility is to have a progress report after users have used the program for a specified period of time. The progress report can incorporate individual feedback or re-direction to an easier or more difficult level. Teachers may also want to have a network reporting option that automatically sends them the students' reports [9].

Within VLU, users are provided with a percentage grade for each task as well as an overall grade for the section completed. This provides users with a clear indication of their areas of weakness, whether it be in specific grammatical structures, writing topic sentences, listening for key words or creating compound nouns. A rating of "good", "average" or "poor" is also given, with 80 percent or higher being good, 79 to 50 as average and below 49 as poor. With this method of reporting, users are oriented within the tri-level system of the program and provided with goals for motivating improvement.

Conclusions

As multimedia producers, our goal is to harness the power of emerging technologies to achieve our educational objectives. With proper planning and design implementation, producers can not only simulate the classroom setting, but enhance it - and thus contribute to an overall rise in the level of educational standards. As Kozma points out, our ability to take full advantage of new technologies depends on the creativity of designers and our understanding of the relationship between these capabilities and learning [10]. This becomes especially important as computer-based multimedia becomes a ubiquitous aspect to learning at all levels [12]; [2]; [7].

This paper has discussed some of the issues involved in designing interactive courseware, with an emphasis on the Higher Education environment. The authors have attempted to use the experience of VLU to identify some of the key challenges involved in the various stages of multimedia design: development environment, design, user feedback and piloting. One of the greatest challenges involved in multimedia design is integrating the freedom-of-choice that makes interactivity what it is, without straying too far away from the sensible guidance necessary for any valuable educational endeavor. Designers are being challenged to create a learning environment that combines learner controlled browsing within a system-encouraged structure. As demonstrated in VLU, this bipolar dynamic is evident in almost every stage of the production process - from navigation to taskwriting to the integration of audio and visual effects. Every interactive learning production has its own set of problems and challenges, which is perhaps what makes multimedia design such an exciting and creative field to be working in. The lessons gained from VLU will continue to improve the program as it is exposed to more users and teachers, and as the development team generate new ideas for a revised version. It is hoped that these insights will contribute to the growing source of knowledge on multimedia design and ultimately lead to better products for students.

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Developing a Web Concordancer for English as Foreign Language Learners

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Quite a few tools and techniques of corpus linguistics have been applied to foreign language teaching and learning. One of the most popular learning tools is the concordancer. It helps language learners to efficiently uncover hidden linguistic patterns in large amount of data and to answer their own questions about the target languages. This type of data-driven language learning has been highly recommended by second language teachers and researchers. However, good concordancing programs and suitable corpora in fact are not widely accessible for second language learners, so many learners cannot participate in data-driven learning. As Internet/World-Wide-Web has become the best platform for distributing educational resources, a web concordancer will provide a data-driven learning environment to students from anywhere at anytime. This paper first reviews several web-based concordancers for ESL/EFL learners (CobuildDirect Corpus Sampler, Hong-Kong Polytechnic Web Concordancer, and Web Concordancer for Gutenburg texts). Then the strengths and weakness of each of these web sites are identified and compared. The last section describes how language faculty at National Taiwan Ocean University (NTOU) develops a web concordancer for Taiwanese EFL learners. It is expected that this web concordancer will be able to provide Taiwanese EFL learners a fast, reliable, and user-friendly environment for data-driven learning.

Keywords: **Web-based English Learning, Data-Driven Learning, Concordancer**

1 Introduction

1.1 Corpus and Concordancer

Linguists working in the Chomskyian paradigm have been using native speakers' intuitions as the key data for linguistic research. More recently, some linguists no longer rely on their intuitions as the main data source, and they have also begun to analyze large amount of written and spoken texts (i.e., corpus) to uncover hidden linguistic generalizations. McArthur & McArthur [7] provided a very clear explanation regarding corpus and corpus linguistics.

> CORPUS [13c: from Latin corpus body. The plural is usually corpora]. (1) A collection of texts, especially if complete and self-contained: the corpus of Anglo-Saxon verse. (2) Plural also corpuses. In linguistics and lexicography, a body of texts, utterances, or other specimens considered more or less representative of a language, and usually stored as an electronic database. Currently, computer corpora may store many millions of running words, whose features can be analyzed by means of tagging (the addition of identifying and classifying tags to words and other formations) and the use of concordancing programs. Corpus linguistics studies data in any such corpus ...

In the past several years, since corpus linguistics has become a very exciting subfield of linguistics. Numerous electronic corpora were created, some of the most well known ones are the followings: Brown Corpus (text samples, American English), Lancaster-Oslo-Bergen Corpus (LOB; text samples, British

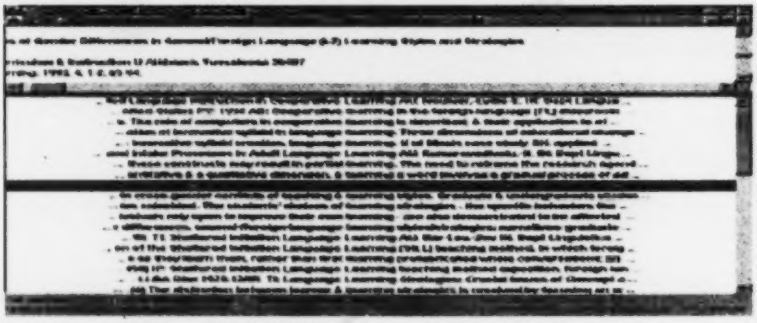
English), London-Lund Corpus (spoken British English), BNC (British National Corpus). Since a corpus often contains millions of words, corpus linguists need to use concordancing programs to uncover the patterns hidden in the huge amount of linguistic data. A concordance, in its simplest form, is an alphabetical listing of the words in a text, given together with the contexts in which they appear. The most common form of concordance today is the Keyword-in-Context (KWIC) index, in which each word is centered in a fixed-length field (e.g., 80 characters). Concordances of the word 'trust' are given below in Figure 1.

Figure 1. Concordances of the word Trust

[p] FOREIGN & Colonial Investment **Trust** has bowed to pressure from its 100,
being able to go one step further and **trust** in the love of another. [p] It took
for m. friends, the House put its **trust** in him and together they faced the
all of his AIDS work. He cajoled the **Trust** into recognising its international
Status [/h] [p] T U European **Trust** is an Authorised Unit Trust Scheme
is that Sinclair, like most second **trust** lenders, doesn't want a 30-year
his grandfather was of Hitler. We **trust** many other Tory MPs will follow his
told him. I don't think he will ever **trust** me again but he had to admit he had
is a unit trust or investment **trust**-only PEP, as you can look up the trip. [p]
[p] Visit the National **Trust's** amazing Victorian folly garden at

More than a dozen of good concordancing programs are available, some well-known programs are the followings: MonoConc Pro, TACT, Word Cruncher, and WordSmith. One computer screen shot of MonoConc Pro is shown below in Figure 2. The lower window shows all the single-line concordances and the upper window shows the larger context of a certain selected concordance.

Figure 2. The Screen Shot of the MonoConc Pro Program.



The applications of corpus linguistics are numerous. According to Cathy Ball [1], these applications can be further divided into the following major domains.

1. Linguistics: to study linguistic competence or performance as revealed in naturally-occurring data. Most applications will require or lead to the creation of annotated text.
2. Diachronic linguistics: texts are all we have; introspection worthless; better to analyze a systematic collection of data than to reuse/reanalyze others' examples.
3. Computational linguistics: to train/test a natural language processing system on a representative sample of the kinds of texts the system is expected to process; to build large lexicons in a given domain ...
4. Applied linguistics: First/second language acquisition research: supplement/replace elicitation, as in 'Linguistics' above
5. Language teaching/learning: language for specific purposes (e.g. use newspaper corpora, corpora of scientific texts); to prepare vocabulary lists based on high-frequency lexical items; to prepare CLOZE tests; to answer ad hoc learner questions ('What's the difference between few and a few?'); to discover facts about language.

Geoffrey Leech [5], a prominent corpus researcher at Lancaster university, pointed out that "...while computers were limited to large mainframes available to the initiated few, computer corpora were largely restricted to research use. But as computers have grown smaller, cheaper, and massively more powerful, their use in teaching has grown immeasurably."

1.2 Data-Driven Learning and Classroom Concordancing

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In recent years, the use of corpus in language teaching and language learning has grown steadily both in Europe and United States. One key approach to corpus in language teaching is the Data-Driven Learning (DDL) or Classroom Concordancing advocated by Tim Johns at Birmingham University. According to Odlin [8], Data-driven learning is an approach to language teaching that gives central importance to developing the learner's ability to "puzzle out" how the target language operates from examples of authentic usage. This approach is particularly associated with the use of computer concordances in the classroom but can be extended to other situations where the students has to work inductively from authentic data. According to Johns [3] data-driven allows language learners to explore a large amount of authentic target language texts by using the searching and indexing power of computer. This approach to second language learning is not only innovative but also powerful since it can help learners to resolve their own learning problems and help them to become independent second language learners.

Kettemann [4] and Stevens [9] suggested that there are several advantages of using data-driven learning. First, concordances give students easy and immediate access to authentic language production with many different styles and genres. Second, a concordancer is an extremely powerful hypothesis testing device on vast amount of data. It allows controlled speculation, makes hidden patterns of language use readily apparent, thus, enhances inductive thinking and exploratory leaning. Through using the concordancer on a regular basis, learners begin to develop strategies for dealing with a wide variety of texts. As a result of this kind of text analysis, learners are able to use concordance as a way of increasing their knowledge of English. Third, DDL allows students to interact with text actively and analytically and allow students to question, explore the word forms, usage, vocabulary, collocation, grammatical features, syntax, and stylistics. Learners assume control of the learning process.

2 The Underuse of Concordancing Tools

As mentioned above, the data-driven learning or classroom concordancing is such an empowering and innovative learning environment. It is an extremely useful tool for learning word usage and grammar of a foreign language. Leech [5] stated that "there is every reason to believe that language corpora will have a role of growing importance in language teaching." Researchers in different locations have been recommending it to language teachers and learners around the world. Nevertheless, classroom concordancing remains not as popular as it deserves to be. Why such a powerful learning tool and environment cannot be more popular?

John Flowerdew [2] pointed out several problems encountered when working with this new and exciting medium. First, many of the concordance lines will contain language which is beyond the proficiency level of the learners. Second, if single-line concordances are used, not all concordance lines may provide enough contexts to make the meaning clear. Third, depending on the size of the corpus and the frequency of the item chosen for concordancing, the concordancer may provide too few or too many examples of the particular usage to be illustrated. Moreover, Ma [6] also highlighted the importance of learner training. It is essential to familiarize learners with the new learning tool and environment before they can benefit from exploring the new environment.

In addition to the problems pointed out by Flowerdew, we believe that the accessibility to searching tools and corpora is another serious obstacle of making data-driven learning more popular. Both good concordancers and corpora mentioned above are not widely accessible to language learners. School or Institutes need to purchase and install good concordancing software on personal computers. Moreover, though there are many electronic texts available on the CD-ROMs and Internet, most texts are copyrighted and teachers cannot freely distribute them to second language learners. Furthermore, some hand-on training on the uses of the concordancing software is necessary since programs have rather different searching interface and functions. Even some educational institutes want to purchase the license of commercial concordancer and some electronic texts are available, students still need to go to the computer laboratory or computer center to use these precious learning resources. These difficulties and inconvenience in accessing concordancer and texts prevent second language learners from engaging in data-driven learning.

If language teachers and researchers can make a concordancing system easily and widely accessible to learners, it is more likely that second language learners will be more willing to explore the new learning environment. In the following sections, we will discuss how the Internet and web might be able to resolve some of the problems we outlined above.

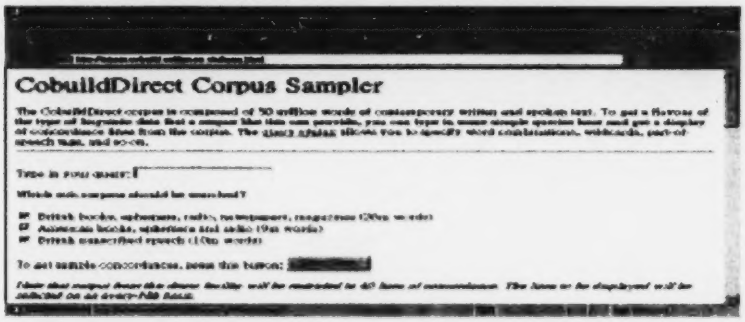
3 Web-based Concordancers

Internet and World-Wide-Web has been recommended as the most powerful platform for delivering/distributing learning materials to many learners. If a concordancing system can be made available via the Internet, second language learners can use any popular web browser to gain access to the web-based concordancing system at anytime from anywhere. They do not need to go the computer center and open the concordancer on a certain computer and load the corpus during the limited open hours.

The ideas of setting up an online concordancer loaded with text corpora have been implemented in several countries. One excellent web concordancer project is provided by Collins COBUILD project in Britain, the project generously provides a web concordancer- CobuildDirect Corpus Sampler, as an extra service for English language learners and teachers. The CobuildDirect corpus is composed of 50 million words of contemporary written and spoken text.

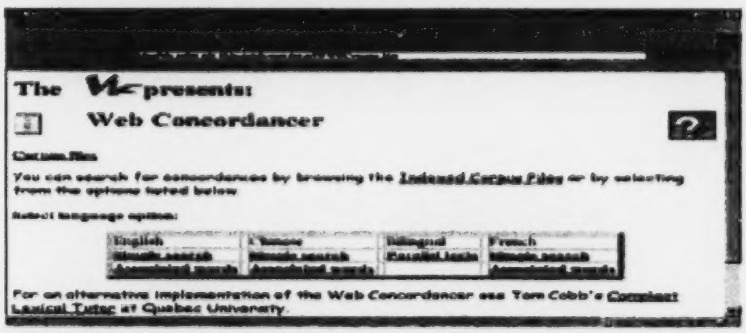
The interface of CobuildDirect Corpus Sampler is shown below in Figure 3. The user can type in some simple queries and get a display of concordance lines from the corpus. The query syntax allows users to specify word combinations, wildcards, part-of-speech tags, and so on. Because the corpus has been tagged automatically with a statistical tagger, we can specify a search on word/TAG combinations by appending an oblique stroke and a part-of-speech tag.

Figure 3. The Interface of CobuildDirect Corpus Sampler



Another interesting project is created and maintained by Chris Greaves and his associates at the virtual language center of Hong-Kong Polytechnic University. The interface of web concordancer is shown below in Figure 4.

Figure 4. Web Concordancer at Hong-Kong Polytechnic University



One interesting web site in the U.S. which is completely based on the Gutenburg electronic texts offers a simple Web-based concordancer, as shown in Figure 5. Although the searching options of this site are not as comprehensive as those of the other two sites mentioned above, it offers an easy-to-use web system for language learners to explore.

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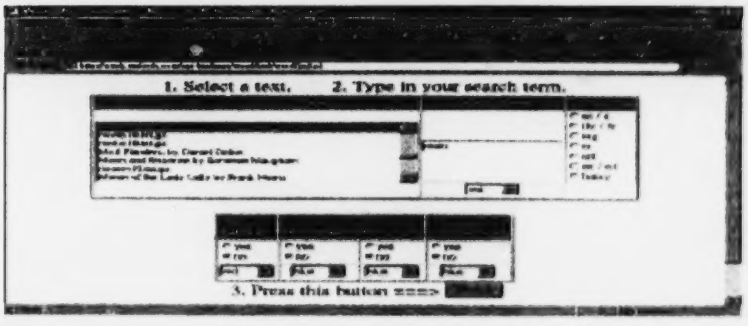
Figure 5. The Interface of Gutenburg Concordancer



4 The Strengths and Weakness of the Existing Web-Based Concordancing Systems

All these web sites mentioned above are useful for ESL/EFL learners. However, each of these web sites has different strengths and weakness. In the following sections, we will examine the three web concordancers more closely and compare their strengths and weakness.

4.1 CobuildDirect Corpus Sampler

CobuildDirect Corpus Sampler is one of the most powerful web concordancer. Its strengths include the wider coverage of texts (50 millions words), tagged corpora which allow learners to specify words and their specific POS (part of speech) or a certain POS tag followed by a keyword. With this powerful search option, learners can specify the words with their part-of-speech. For instance, if they want to find the usage of trust as a verb, they can simply specify the query as trust/VERB.

Its weakness for ESL/EFL learners outside of Britain includes the slow connection speed, single-line concordance output without larger contextual information, and the limited numbers of concordance output. Many students in our writing classes complain that the connection to this site via TANET (Taiwan Academic Network) is fairly slow. They often lose their patience to search the words they want to know more about because of the poor Internet connection. Besides, the system only generates single-line concordance, so the contextual information is fairly limited. The users cannot look at the larger contexts to better understand the usage of the keyword. Last, since this is a sampler, the system at most can only supply about 40 examples for a particular query; this might not be enough for words with complicated meaning and usage.

4.2 Hong-Kong Polytechnic University

Compared with the CobuildDirect Sampler, the Hong-Kong Polytechnic University web concordancer has a faster connection. In addition, it also allows learners to click on the keyword to expand a single-line concordance to view its larger context, as shown in Figure one above. As for its weakness, the connection speed to this site is still not adequate but it is faster than the speed to COBUILD site. Besides, the corpora available online at Polytechnic University are not tagged with part-of-speech tags, so the Polytechnic web concordancer does not allow for words plus POS tags search. Students indicate that they sometimes need to search a word with a particular part-of-speech so that they can locate the specific information they need more efficiently.

4.3 The Gutenburg Concordancer in the U.S.

This site is not as popular as the two sites mentioned above. All of its corpora came from the well-known Gutenburg free electronic text project, and it contains about 80 million words. Gutenburg offers the electronic texts without copyright problem. However, based on our test, this site has the slowest connection from Taiwan. Moreover, the users can only search one text file at a time, so they often cannot find the words they want to know about. All the texts are also not tagged.

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The following table summarize all the strengths and weakness of these three different web concordancers.

Table 1. The Comparison of Three Different Web Concordancers

	Hong-Kong PolyTechnic Web Concordancer	COBUILD Sampler	Gutenburg Web Concordancer
Connection Speed	Moderate speed	Slower	Slowest
Larger Contexts for Keywords	Available	Not available	Not available
Tagged Texts	Not tagged	Automatic tagged	Not tagged
Text Coverage	Several million-word text files	Several large corpora about 50 million words	About 80 million words
Learner Corpora	Available	Not available	Not available

5 National Taiwan Ocean University (NTOU) Web Concordancer

With a research grant from NSC (National Science Council) of Taiwan, a research team at National Taiwan Ocean University created a web concordancer. In this project we not only try to provide a faster and more reliable concordancing system open to all interested English teachers and users but also try to overcome some weakness of currently existing web-based concordancers.

Based on the comparison of the three major web concordancers. We would like to create a web concordancer with the following features and options for Taiwanese EFL learners and teachers.
1.Fast and reliable connection and quick response.
2.Large corpora for ESL/EFL learners and teachers (including both NS corpora and NNS learner corpora).
3.Larger contexts for any searched word.
4.Tagged corpora files that allow learners/teachers to search words with POS tags.

Since we have only limited funds, we do not expect to surpass the commercial web site such as Collins COBUILD or the well-funded project of Hong-Kong Polytechnic University. We aim at creating a fast, reliable, and friendly web concordancer for Taiwanese EFL learners and teachers. We will discuss the four goals outlined above in details in the following sections.

First, the connection to NTOU web concordancer can be faster since it is built on the TANET. For TANET user, our web concordancer will be able to respond to learner's queries within 15-20 seconds. Moreover, to increase the searching speed, we reduce each corpus size to around 10-15MB. This is a technique adopted at Hong-King Polytechnic University.

Second, we expect to have large corpora. Due to the copyright restrictions, we have to rely mainly on the free electronic texts from Gutenburg projects. We are also negotiating with several local English newspapers about putting their electronic texts online for educational purpose. In addition to the native speaker corpora, we also have a smaller learner corpus available. During the past three years, we have been collecting English writing samples of Taiwanese college students. Now we have a 200,000-word EFL learner corpus, and this corpus will be a very precious resource for language teachers or researchers to better understand Chinese EFL learners' interlanguage. The interface of NTOU web concordancer is shown below in Figure 6.

Figure 6. Interface of NTOU Web Concordancer

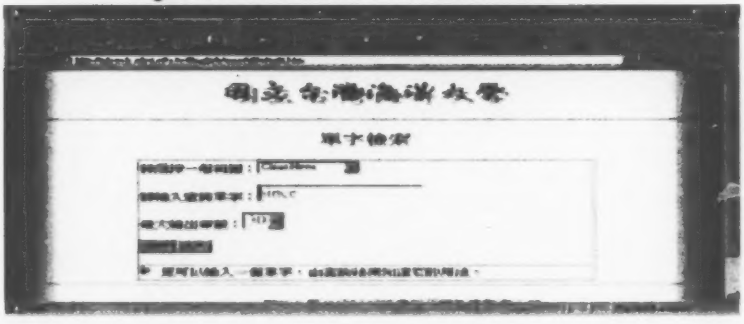

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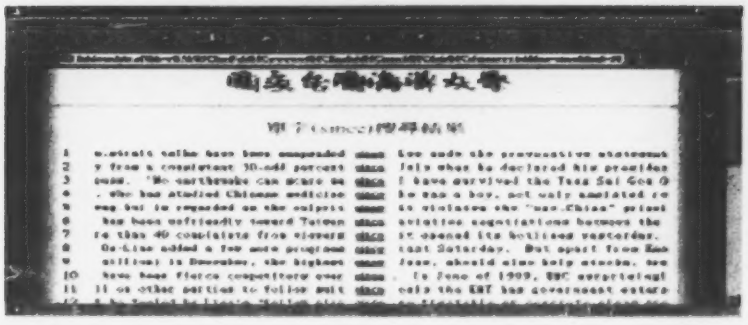
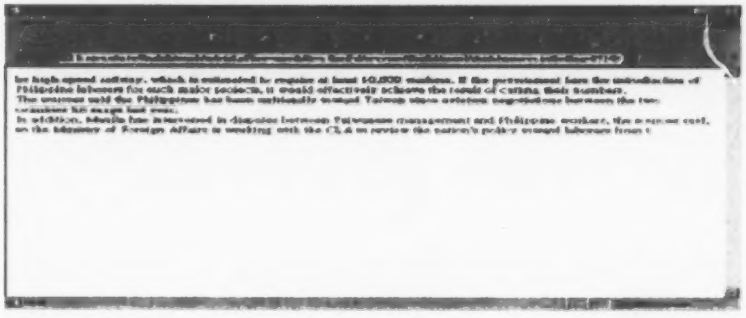
Figure 7. The Web Concordance Output



Third, since the display of larger linguistic contexts are fairly important when learners analyze the usage or the meaning of particular words or phrases. To make the data-analysis process more efficiently, NTOU web concordancer allows learners to have a convenient access to the larger context by clicking on any single-line concordance, as shown in Figure 7. An instance of the contextual information is shown below in Figure 8.

Figure 8. Larger Linguistic Context of a Concordance



Last, some learners indicated that they prefer to have the option of searching both words/phrases and POS tags when using web-based concordancers since a tagged corpus can help learners to filter out irrelevant information and help them locate the information they need more efficiently. Though the text tagging process could be time-consuming and difficult, we have adopted some tools to create tagged corpora. The tools and techniques used in our project are described below.

5.1 Tagged Corpora

Tagging a corpus with millions of words manually is not feasible. How can COBUILD project provide such a wonderful service? In fact, they use their automatic POS taggers to carry out the POS tagging. For our project, we also purchase a useful tagger to accomplish the daunting tagging tasks.

In fact, there are quite a few taggers available. We have compared various taggers and consider the limited resources we have in hand. We decided to adopt the inexpensive automatic POS (part-of-speech) taggers, the TOSCA tagger, to annotate the corpora. The TOSCA Research Group is a team of corpus linguists at the University of Nijmegen. One focus of their research is on the development of Tools for Syntactic Corpus Analysis (TOSCA). Its tag set consists of 17 major wordclasses. With features for subclasses and additional semantic, syntactic and morphological information, the total number of different tags is 220.

It is not possible for ESL teachers or learners to use the 220 tags. So we decide to keep the system simple by converting the detailed tagging system into to the major 17 word classes so users can use these tags more easily. For instance, if one needs to know the usage of 'issue' as a verb, then he/she can input a query, issue/VB, to the system. The outcome of word plus tag search is shown below in Figure 9. The POS tags would allow users to search the corpora more efficiently.

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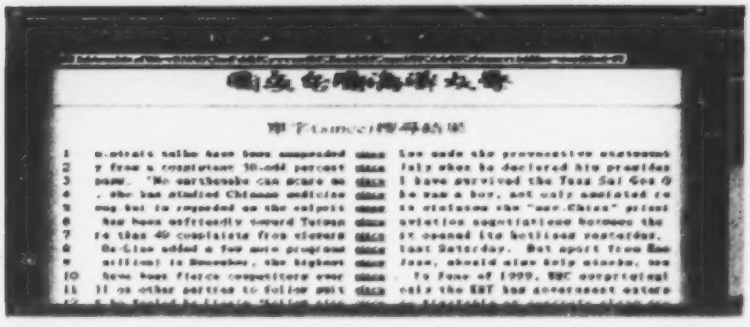

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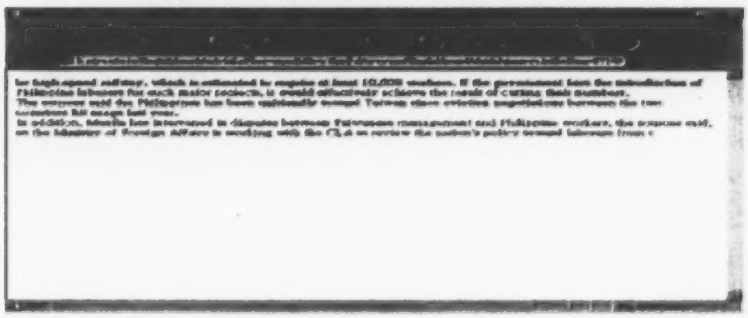

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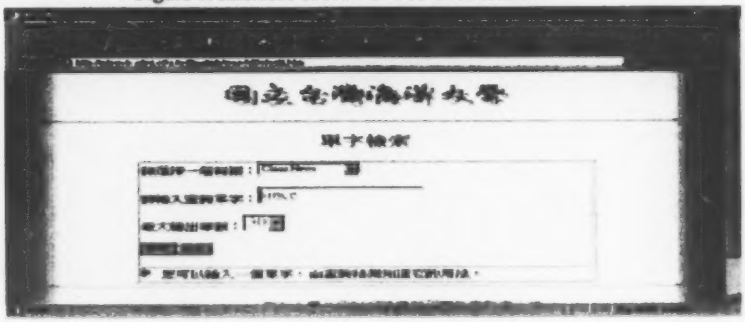

Figure 9. Search Outcomes of Word plus Tag

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Although NTOU web concordancer has been set up and running for a short period of time, students at NTOU show positive attitude toward this new learning tool. Some students suggest that the web site should be introduced to the whole university community since they found the searching tool to be useful for English learning. It is rather encouraging to receive students' positive feedback.

However, there are still difficulties in using web concordancers. According to Sun [10], the problems of using web concordancers can be divided into two categories: one related to computing resources, another related to the difficulties of using or interpreting the concordance output. For computing resources, NTOU web concordancer still has much room for improvement. For instance, we need put in more suitable text corpora and the search speed should be faster. Besides, the automatic tagging of texts still contains some serious errors.

As for the difficulties of using or interpreting the concordance output, Ma [6] and Sun [10] pointed out that learners need training on using concordancer. For learner training, we might create an online tutorial on the use of concordancer so learners can use the system more effectively. Sun [10] also indicated that it is rather time consuming to do data analysis. Sun pointed out that the concordance output seems too large to be manageable in some cases, and learners can be overloaded with information. In fact, a corpus contains either too much or too little information would cause troubles for language learners. Flowerdew [2] points out that we need to choose our corpora more carefully and make sure the corpora will meet the needs of learners. We will continue to collect users' feedback and further improve our concordancing system.

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As for the difficulties of using or interpreting the concordance output, Ma [6] and Sun [10] pointed out that learners need training on using concordancer. For learner training, we might create an online tutorial on the use of concordancer so learners can use the system more effectively. Sun [10] also indicated that it is rather time consuming to do data analysis. Sun pointed out that the concordance output seems too large to be manageable in some cases, and learners can be overloaded with information. In fact, a corpus contains either too much or too little information would cause troubles for language learners. Flowerdew [2] points out that we need to choose our corpora more carefully and make sure the corpora will meet the needs of learners. We will continue to collect users' feedback and further improve our concordancing system.

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Development and Evaluation of a CALL System for Supporting the Writing of Technical Japanese Texts on the WWW

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This paper describes the development and evaluation of a Computer Assisted Language Learning (CALL) system for supporting the writing of technical Japanese texts on the WWW. To analyze discourse structure of technical Japanese texts, cohesive expressions are used as cue words. The rules for analyzing texts are based on micro-level and macro-level information, namely cohesive expressions and headlines. A CALL system for helping foreigners to learn to write technical Japanese texts is developed using Natural Language Processing (NLP) techniques. The main functions of the system are: automatically detecting headlines and cohesive expressions in technical Japanese texts, displaying this information on the WWW, and extracting examples from the corpus of technical Japanese texts. The results of a system evaluation show that the system obtained a high degree of accuracy on extraction of cohesive expressions and headlines by using the revised rules set proposed in this study. Furthermore, two evaluation experiments are conducted to examine the effectiveness of the system. The system is evaluated in terms of subjects' intuitive impression and actual usage of the system in the two experiments, respectively. The results of the study show that the instructive effectiveness of the system. The result of the interview also shows that the system is not only suitable for technical Japanese writing but also for Japanese language learning.

Keywords: **Computer Assisted Language Learning, Natural Language Processing, evaluation, technical Japanese texts**

1 Introduction

The aim of this research was to construct a Japanese learning environment for foreign students on the Internet. For students in science and technology universities, there is little time for enrolling in a regular Japanese language course, which involves spending a lot of time on experiments, studies and research, etc. The Internet environment is provided in almost all laboratories and can become an excellent virtual learning environment if there is a Japanese learning system which can be accessed on the Internet anytime and anywhere. The Internet has stimulated many new approaches to language instruction and learning, and it provides a great opportunity to learn one of the most important skills, writing. This is especially true for students in the science and engineering fields who need to write technical texts.

However, almost all CALL systems are concerned with learning how to improve one's reading and listening skills. Few systems are concerned with writing because of the difficulty of implementing an analysis of sentences typed by students who need to learn to phrase their own sentences freely without following any predefined rules. More and more researchers, therefore, use Natural Language Processing (NLP) techniques to analyze learners' typed sentence [9][16]. Recently, NLP techniques designed for use with CALL have attracted special attention (see, for example, [21][22], etc.), as this is expected to help improve writing skills.

Yang and Akahori [28][29] developed a Japanese writing CALL system using NLP techniques which can be used for learning and producing the Japanese passive voice on the WWW. Comparison of two Web-based CALL systems showed that the method of 'free input' and 'feedback corresponding to learners' typed sentence' is better than the method of 'multiple choice' and 'feedback that only displays the correct answer' [31]. Furthermore, an evaluation of the learning histories of the subjects who have actually used the system through the Internet shows that the system obtained a high degree of accuracy and instructional effectiveness [29]. These results demonstrate the effectiveness of the CALL system for writing using NLP techniques on the Internet.

Having sufficient vocabulary and grammatical knowledge is important when learning a foreign language. However, although vocabulary and grammatical rules are provided for correct sentence building in a foreign language, this knowledge alone is not enough. Being able to form correct sentences is by no means enough when it comes to expressing complex thoughts. The major problem for most foreigners learning Japanese is, apart from the writing system, the building of sentences: that is, knowing the corresponding words, the postfixes signaling the word's function (*de*, *ni*, etc.) and the position of the words (verbs final form). It is of paramount importance to learn how to structure one's thoughts: i.e., how to make an outline, how to signal the relative importance of a piece of information, and how it relates to the whole. Therefore, in order to write or to comprehend a structured sentence, it is necessary to learn how to associate sentences, in addition to having a good command of vocabulary and grammar. The connection between sentences can be described as conjunction of adjacent sentences, which is an important criterion for writing a good text as per research in *cohesion* or *discourse structure* [1][3][13][17][26]. Unfortunately, discourse structure is not amenable to single-sentence grammatical analysis, because there are no 'discourse grammars' [11].

Many methods concerning the analysis of discourse structure have been proposed in previous related works. Mann and Thompson's [18][19] rhetorical structure theory (RST) is an influential theory of text structure that is being extended to serve as a theoretical basis for computational text planning. RST postulates that a set of about 25 relations suffices to represent the relations that hold within normal English texts. Most relations have a cue word or phrase which informs the listener how to relate the adjacent clauses. RST can be applied to a computational model. There have been attempts at text generation using RST for the implementation of a prototype of the theory [10][20]. Cue words are also widely used in the identification of rhetorical relations among portions of a text [8][15][24]. Hobbs claims that coherence in conversations and in texts can be partially characterized by a set of coherence relations, which are classified into four categories. Hovy [10] collected and taxonomized the discourse segment relations; this set of relations contains three taxonomies of approximately 120 relations. Hirschberg and Litman [7] also summarize the proposed meanings of items classed as cue words in six computational and linguistic treatments.

In most of these earlier works, emphasis was put on the knowledge that is necessary for recognizing discourse structure. The problem of inference based on that knowledge was also emphasized. However, this does not mean that knowledge can be constructed easily from information available on computers. Constructing common knowledge to implement a practical system is often beyond the capabilities of current NLP techniques. Kurohashi and Nagao [14] proposed an automatic method for detecting discourse structure by checking surface information in text sentences. The information included 'clue expressions', 'occurrence of identical/synonymous words/phrases', and 'similarity between two sentences'. Their result indicates that, in the case of technical Japanese texts, considerable portions of discourse structure can be identified by incorporating the three types of surface information.

Since there are few practical CALL systems that use discourse analysis, the purpose of this study is to develop such a system for helping learners to write technical Japanese texts on the WWW. Section 2 describes the implementation of the system using NLP techniques. The authors took a similar approach to Kurohashi and Nagao [14], namely using surface information in texts. The rules for analyzing technical Japanese texts are based on micro-level (cohesive expressions) and macro-level (headlines) information. Section 3 describes the study that evaluates the effectiveness of the system in two experiments.

2 Implementation of the system

2.1 Method

The combination of cohesive expressions and headlines are employed in the implementation of the system. To examine discourse structure of technical Japanese texts, the classification of basic expressions by Yamazaki et al. [27] is adopted in this study. The reason for this is that their classification covers most of the

elements of technical Japanese texts. Based on their findings, the authors have classified cohesive expressions into 15 categories as follows: *comparison, contrast, analogy, cause and reason, basis, composition and enumeration, presentation, definition, classification, hypothesis and conditions, change of state, process of change, change with prerequisites, means and methods, selection*. The total number of expressions is 82. All of the expressions are converted into regular expressions to make the rules. In all, 654 distinctions in the regular expressions were extracted from the 15 categories of cohesive expressions. These formed 654 original rules, which are used in the process of analysis.

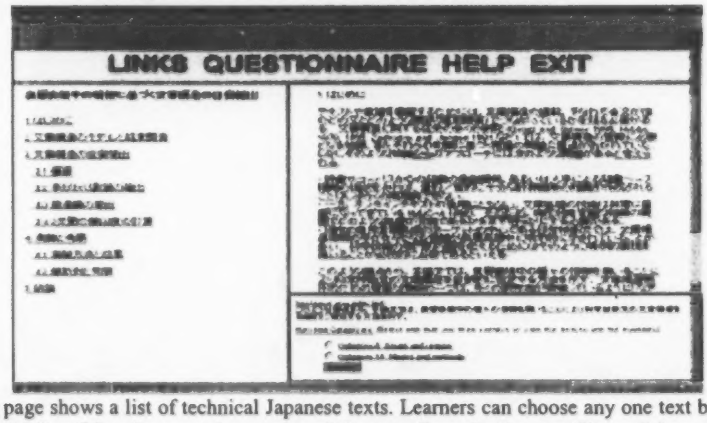
There are two patterns of rules: one is for 'simple pattern matching' and the other is for 'discourse analysis'. The former, called rule set A, is written as a regular expression form and the latter, called rule set B, is written as a regular expression combined with the result of morpheme analysis and syntax analysis. The rule in rule set B is written in a more restrictive form to improve the accuracy of discourse structure analysis. For example, if a sentence is applied to rule set A, it is then analyzed by the morpheme analysis and syntax analysis and the result will be matched to rule set B.

There are many text books on good writing, which nearly all contain a lot of material concerning the different kinds of categories or conceptual bricks at the discourse level out of which texts are built (see, for example, [4][5][6][12][25][26]. However, it is difficult to detect the text structure by just using their framework because it is too extensive and the varieties of different formats used by people for building technical texts too numerous. Instead of predefined framework, headline is used as macro-level information in this study. There are several reasons why the authors decided to use 'headline' instead. First, a well-chosen headline allows the reader to infer the text structure. Second, different formats of texts can be analyzed independently of the texts' style by using the headline. Third, it is easier to understand when the headline is displayed rather than a tree structure because the headline is a part of the original text.

2.2 The discourse structure analysis module

The discourse analysis module of the system contains 'simple pattern matching', 'morpheme analyzer', 'syntax analyzer', and 'discourse analyzer' components. First, the headlines are extracted and the Japanese texts are divided into sentences using several heuristic rules. Then all the sentences in all texts are matched with all the rules in the 'simple pattern matching' component. The 'rules for pattern matching' is used during the process of pattern matching. Because of the exclusive character of almost all of the rules, they are written in order of frequency to reduce the running time on the computer. The frequency of rules is made from the 'rules corpus'. The present system analyzes Japanese text sentences with the morpheme analyzer and syntax analyzer to check the dependency of sentences in the case grammar. Therefore, each cue word in the rules is not only matched against the word itself, but also against the 'parts-of-speech' of the cue word. Only sentences that match the rules written in restrictive form are needed for morpheme analysis and syntax analysis. This takes into consideration the problem of computer running time. The 'rules for discourse analysis' is matched again in restrictive form after the process of syntax analysis. The additional information (parts-of-speech, tense, etc.) is checked to identify the cohesive expressions, especially in the case where one sentence is matched with two or more rules.

Figure 1. One screen shot of discourse structure analysis



The learning page shows a list of technical Japanese texts. Learners can choose any one text by clicking the hyperlink on the list. When learners choose one of the texts from the list, headlines of the selected text are

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analyzed and displayed first to help learners grasp the whole text structure. Secondly, learners can click on the headline of any part of the text that they want to read. Then the original sentences corresponding to the headline are displayed with the extracted cohesive expressions. The cue words in the cohesive expressions are displayed in color to enable learners to focus on it more easily. Learners can click on any cue words to further find out the cohesive expressions corresponding to the sentences. They can also refer to examples that correspond to the cohesive expressions from the 'examples corpus'. Figure 1 shows one screen shot of the system (text source: [14]). As shown in this figure, the headlines of the Japanese text are analyzed and displayed on the left side of the browser. The headlines show the structure of the text. On the right side, the original sentences corresponding to the selected headline are displayed on the upper part with the cohesive expressions extracted and a link made. When the cue word '*kotoniyori*' (in the first line of the third paragraph) is clicked, the matched cohesive expressions are displayed on the bottom right side of the browser.

2.3 System evaluation of the discourse structure analysis module

A system evaluation is conducted to evaluate the performance of the discourse structure analysis module on 24 technical Japanese texts. The system evaluation is designed for text analysis in two stages (pattern matching in Stage 1 and discourse analysis in Stage 2). The analysis consists of 3 items on both stages: *headline extraction*, *cohesive expression extraction* and *frequency of the rules*. The accuracy ratio of the headline extraction in Stage 1 is 95.22% on average. After a heuristic rule is added, the result of the headline extraction using the revised rules in Stage 2 gained an exceedingly high accuracy rate of 99.17%. The accuracy of the cohesive expression extraction in Stage 1 is 70.23% on average. On the other hand, the accuracy in Stage 2 improved to 92.70% on average. This result shows that using the rules combined with morpheme analysis and syntax analysis gained a higher degree of accuracy than only using the rules of simple pattern matching. After the cohesive expression extraction, the frequency of rules is calculated. The result of 'frequency of the rules' is saved to the 'rules corpus'. The order of frequency is taken as the order of the rules to reduce the running time on the computer.

2.4 The system for supporting technical Japanese texts writing

A CALL system is developed to help learners in the writing of technical Japanese texts. The system is implemented in terms of headlines and cohesive expressions, which is based on the method of the discourse structure analysis module. For headlines supporting, a connection between headline and texts corresponding to the headline is made automatically. Learners can click on any headline to immediately link to the content of texts corresponded to it. For cohesive expressions supporting, examples with the selected cohesive expressions are automatically extracted from the corpus of technical Japanese texts. Learners can refer to these examples to help them improve their writing skills.

The flow of the system is as follows:

(1) Learners register themselves to use the system. An ID number is given after registration. The ID number is used to identify the learner because a log of all learning histories is registered during the operation of the system.
(2) The page for headlines input is appeared. Learners can free input their headlines here. When learners completed their construction of headlines, each headline is automatically linked and displayed on the left side of the browser. The left side of Figure 2 shows an example of linked headlines.
(3) When learners choose one of the headlines, a text box is appeared on the top right side of the browser. Learners can compose their texts corresponded to the clicked headline in the text box. The top right side of Figure 2 shows an example of texts input.
(4) When learners click on the 'basic expressions' button on the bottom right side of the browser, the categories of cohesive expressions is appeared on a new page. Each category is classified further into sub-categories. When learners choose one of the sub-categories from the list, examples are automatically extracted from the corpus of technical Japanese texts and the result is displayed on the bottom of the browser. Figure 3 shows that examples are displayed corresponded to the selected sub-category of cohesive expressions.

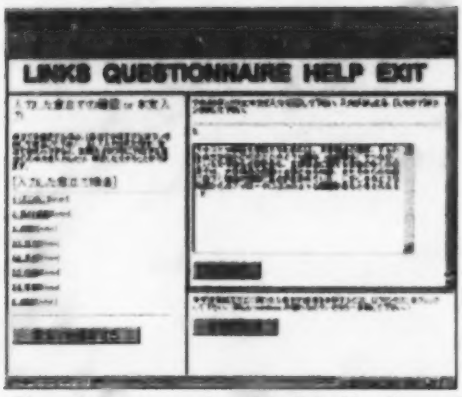

Figure 2. One screen shot of the linked headline and texts input

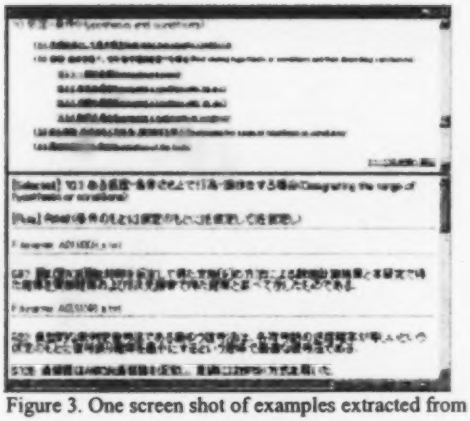

Figure 3. One screen shot of examples extracted from corpus

3 The study

Two evaluation experiments were conducted to examine the effectiveness of the system. The system is evaluated in terms of subjects' intuitive impression and actual usage of the system in the experiment 1 and the experiment 2, respectively. Thirty-three subjects participated in the experiment 1; the other seven subjects participated in the experiment 2. The subjects almost use the WWW and computer everyday.

3.1 Experiment 1

The purpose of the experiment 1 was to examine the functions of the system in terms of subjects' intuitive impression. Therefore, the experiment was designed to make a comparison between the system with the popular and well-known word processor: the MS-Word. During the experiment, the subjects were asked to look at the operation of the system and the MS-Word using video for duration of 10 minutes. The subjects were informed that they would be asked to fill in the questionnaire concerning the comparison of the two systems. The questionnaire consisted of 3 categories: *items of technical sentences writing*, *items of general sentences writing*, and *items of system operation*. The subjects were asked to rate 24 items on a 5-point scale. The subjects were also asked to make comments on the system.

Figure 4 shows the rating of the system and the MS-Word for each item with the 3 categories in experiment 1 and 2. The result of the experiment 1 shows that the system obtained a higher rating than the MS-Word on all of the items of technical sentences writing. For those items of general sentences writing and system operation, the result shows that the MS-Word obtained a higher rating than the system or there was no significant difference on the two systems. However, the system obtained a higher rating than the MS-Word on items 18 ('Sentences can be efficiently made') and 15 ('It is suitable for learning').

Comments on the system are summarized as follows: Almost all of the subjects answered that it is necessary to involve the functions to access other objects, such as figures, tables and numerical expressions, etc. Since the system is emphasized on the discourse analysis of technical Japanese texts using NLP techniques, the target of the system is limited to 'texts'. However, figures, tables and numerical expressions are important components of technical texts. Therefore, development of such visual tools for supporting these objects is expected.

3.2 Experiment 2

The result of the experiment 1 suggests that the system is preferred to the MS-Word on technical texts writing. However, actual usage of the system is not evaluated. Therefore, in order to examine the effectiveness of the system in terms of actual usage of the system by foreign students, experiment 2 was conducted. During the experiment, the subjects were asked to compose a technical Japanese text using the system. The subjects were asked to write sentences concerning their specialization instead of a given task because a variety of subjects' different fields. After the composition is completed, the subjects were asked to fill in the questionnaire concerning the comparison of the system and the MS-Word. The questionnaire is identical to experiment 1, which is divided into 3 categories. Finally, the subjects were interviewed based on

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their response to the questionnaires.

From Figure 4, the result of the experiment 2 shows that the system obtained a higher rating than the MS-Word on all of the items of technical sentences writing, which is consistent with the result of experiment 1. For those items of general sentences writing and system operation, the result shows that the subjects preferred the system, or the MS-Word or there was no significant difference on the two systems. Comparing this result to experiment 1, the system obtained a higher rating than the MS-Word on items 18 ('Sentences can be efficiently made') and 15 ('It is suitable for learning'), which is consistent with the result of experiment 1. On the other hand, some items obtained different result between the two experiments. These items can be divided into 3 types: First, items 7 ('I want to recommend it to my friends') and 24 ('I want to use it more') are rated from 'no significant difference' to 'a higher rating to the system'. Second, item 2 ('It is friendly') is rated from 'a higher rating to the MS-Word' to 'no significant difference'. Third, item 11 ('It is easy to see') is rated from 'no significant difference' to 'a higher rating to the MS-Word'.

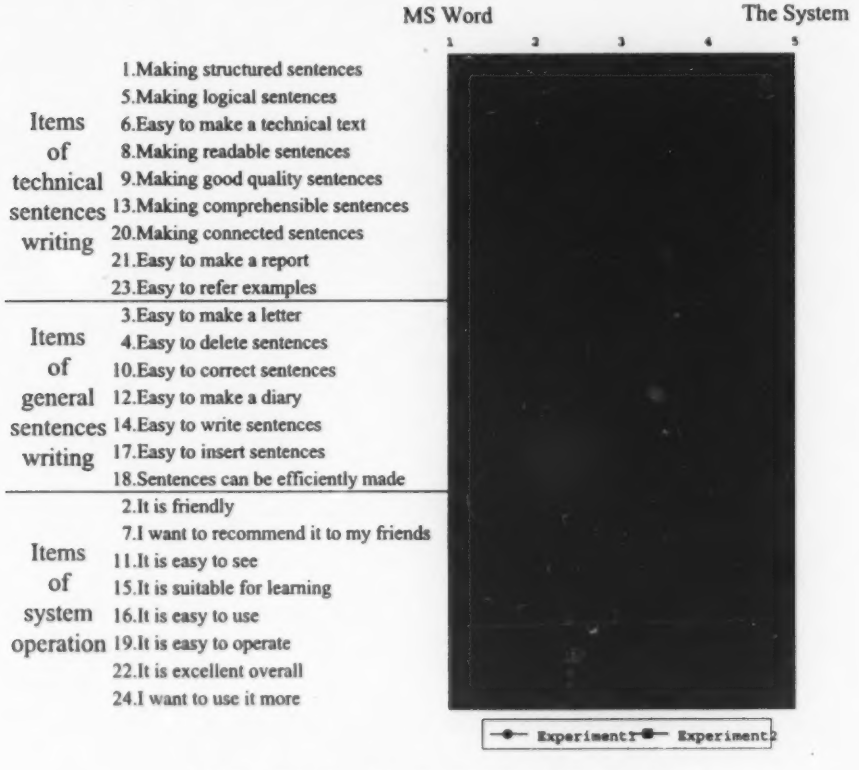

Figure 4. The rating for each item in Experiment 1 and 2

The subjects were asked to give reasons for their responses to the questionnaire items during the interview. The result of the interview concerning the functions of the system is divided into 4 types and summarized as follows: First, for automatically analyzing and displaying headlines, almost all of the subjects answered that it is very useful because they can click on any headline to immediately read the content of texts corresponded to it. The subjects also answered that headlines can be treated as an important role to help them to grasp the whole structure of the texts. Second, for automatically analyzing and displaying cohesive expressions, almost all of the subjects answered that it is very useful because they can find it is easier to convey their thoughts using explicit cohesive expressions. The subjects also answered that it is easy to find their errors because cohesive expressions in the texts are highlighted. Third, for referring to examples from corpus, almost all of the subjects answered that it is very efficient to writing because they can save a lot of time for finding examples from other references. The subjects also answered that they can imitate and learn more examples from the output of corpus. They can learn very much from the process of referring to examples in different texts, especially if there are many different usages in an expression. Fourth, for

Japanese language learning, almost all of the subjects answered that the system is suitable for learning because the system supports learners to learn technical Japanese writing in a structural way in terms of automatically analyzing and displaying headlines and cohesive expressions in technical Japanese texts. The subjects also answered that they can learn not only new cohesive expressions but also correct usages of cohesive expressions even they already know one of them.

Other comments on the system are summarized as follows: Almost all of the subjects answered that it is desired to improve the system to support the functions of electronic dictionary, thesaurus, grammar checking, etc. Therefore, construction of a good electronic dictionary for technical texts writing is considered as an important issue. Moreover, some subjects answered that it is better to extract examples form corpus according to learners' specialization than only random accessing to the corpus. From this result, constructing a corpus should not only consider the number of texts but also the balance of texts in each field.

4 Conclusion

In this paper, the authors describe the development and evaluation of a CALL system for supporting the writing of technical Japanese texts on the WWW. To analyze discourse structure of technical Japanese texts, the rules for analyzing texts are based on micro-level and macro-level information, namely cohesive expressions and headlines. A CALL system for helping foreigners to learn to write technical Japanese texts has been developed using NLP techniques. The system has the following functions: automatically detecting headlines and cohesive expressions in technical Japanese texts, displaying this information on the WWW, and extracting examples from the corpus of technical Japanese texts. The results of a system evaluation show that the system obtained a high degree of accuracy on extraction of cohesive expressions and headlines by using the revised rules set proposed in this study.

The results of the study show that the instructive effectiveness of the system. The result of the interview also shows that the system is not only suitable for technical Japanese writing but also for Japanese language learning. Based on the functions of the system, these results can be explained as follows: First, headlines can be treated as an important role to help learners to grasp the whole structure of the texts. Second, cohesive expressions often explicitly appear in the surface expressions of technical Japanese texts. Thus, it seems important and necessary to use these explicit cohesive expressions to structure one's thoughts in technical Japanese texts. Foreign learners especially may find it is easier to convey their thoughts using explicit cohesive expressions because these can be treated as an indicator of a discourse. Third, the corpus consists of the actual usage in technical Japanese texts from different fields. Instead of predefined examples, examples are automatically extracted from the corpus. Therefore, learners can learn very much from the process of referring to examples in different texts if there are many different usages in an expression. They can also save a lot of time for finding examples from other references.

In conclusion, the system is suitable for learning because the system supports learners to learn technical Japanese writing in a structural way in terms of automatically analyzing and displaying headlines and cohesive expressions in technical Japanese texts.

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Development and Evaluation of a CALL System for Supporting the Writing of Technical Japanese Texts on the WWW

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This paper describes the development and evaluation of a Computer Assisted Language Learning (CALL) system for supporting the writing of technical Japanese texts on the WWW. To analyze discourse structure of technical Japanese texts, cohesive expressions are used as cue words. The rules for analyzing texts are based on micro-level and macro-level information, namely cohesive expressions and headlines. A CALL system for helping foreigners to learn to write technical Japanese texts is developed using Natural Language Processing (NLP) techniques. The main functions of the system are: automatically detecting headlines and cohesive expressions in technical Japanese texts, displaying this information on the WWW, and extracting examples from the corpus of technical Japanese texts. The results of a system evaluation show that the system obtained a high degree of accuracy on extraction of cohesive expressions and headlines by using the revised rules set proposed in this study. Furthermore, two evaluation experiments are conducted to examine the effectiveness of the system. The system is evaluated in terms of subjects' intuitive impression and actual usage of the system in the two experiments, respectively. The results of the study show that the instructive effectiveness of the system. The result of the interview also shows that the system is not only suitable for technical Japanese writing but also for Japanese language learning.

Keywords: **Computer Assisted Language Learning, Natural Language Processing, evaluation, technical Japanese texts**

1 Introduction

The aim of this research was to construct a Japanese learning environment for foreign students on the Internet. For students in science and technology universities, there is little time for enrolling in a regular Japanese language course, which involves spending a lot of time on experiments, studies and research, etc. The Internet environment is provided in almost all laboratories and can become an excellent virtual learning environment if there is a Japanese learning system which can be accessed on the Internet anytime and anywhere. The Internet has stimulated many new approaches to language instruction and learning, and it provides a great opportunity to learn one of the most important skills, writing. This is especially true for students in the science and engineering fields who need to write technical texts.

However, almost all CALL systems are concerned with learning how to improve one's reading and listening skills. Few systems are concerned with writing because of the difficulty of implementing an analysis of sentences typed by students who need to learn to phrase their own sentences freely without following any predefined rules. More and more researchers, therefore, use Natural Language Processing (NLP) techniques to analyze learners' typed sentence [9][16]. Recently, NLP techniques designed for use with CALL have attracted special attention (see, for example, [21][22], etc.), as this is expected to help improve writing skills.

Yang and Akahori [28][29] developed a Japanese writing CALL system using NLP techniques which can be used for learning and producing the Japanese passive voice on the WWW. Comparison of two Web-based CALL systems showed that the method of 'free input' and 'feedback corresponding to learners' typed sentence' is better than the method of 'multiple choice' and 'feedback that only displays the correct answer' [31]. Furthermore, an evaluation of the learning histories of the subjects who have actually used the system through the Internet shows that the system obtained a high degree of accuracy and instructional effectiveness [29]. These results demonstrate the effectiveness of the CALL system for writing using NLP techniques on the Internet.

Having sufficient vocabulary and grammatical knowledge is important when learning a foreign language. However, although vocabulary and grammatical rules are provided for correct sentence building in a foreign language, this knowledge alone is not enough. Being able to form correct sentences is by no means enough when it comes to expressing complex thoughts. The major problem for most foreigners learning Japanese is, apart from the writing system, the building of sentences: that is, knowing the corresponding words, the postfixes signaling the word's function (*de*, *ni*, etc.) and the position of the words (verbs final form). It is of paramount importance to learn how to structure one's thoughts: i.e., how to make an outline, how to signal the relative importance of a piece of information, and how it relates to the whole. Therefore, in order to write or to comprehend a structured sentence, it is necessary to learn how to associate sentences, in addition to having a good command of vocabulary and grammar. The connection between sentences can be described as conjunction of adjacent sentences, which is an important criterion for writing a good text as per research in *cohesion* or *discourse structure* [1][3][13][17][26]. Unfortunately, discourse structure is not amenable to single-sentence grammatical analysis, because there are no 'discourse grammars' [11].

Many methods concerning the analysis of discourse structure have been proposed in previous related works. Mann and Thompson's [18][19] rhetorical structure theory (RST) is an influential theory of text structure that is being extended to serve as a theoretical basis for computational text planning. RST postulates that a set of about 25 relations suffices to represent the relations that hold within normal English texts. Most relations have a cue word or phrase which informs the listener how to relate the adjacent clauses. RST can be applied to a computational model. There have been attempts at text generation using RST for the implementation of a prototype of the theory [10][20]. Cue words are also widely used in the identification of rhetorical relations among portions of a text [8][15][24]. Hobbs claims that coherence in conversations and in texts can be partially characterized by a set of coherence relations, which are classified into four categories. Hovy [10] collected and taxonomized the discourse segment relations; this set of relations contains three taxonomies of approximately 120 relations. Hirschberg and Litman [7] also summarize the proposed meanings of items classed as cue words in six computational and linguistic treatments.

In most of these earlier works, emphasis was put on the knowledge that is necessary for recognizing discourse structure. The problem of inference based on that knowledge was also emphasized. However, this does not mean that knowledge can be constructed easily from information available on computers. Constructing common knowledge to implement a practical system is often beyond the capabilities of current NLP techniques. Kurohashi and Nagao [14] proposed an automatic method for detecting discourse structure by checking surface information in text sentences. The information included 'clue expressions', 'occurrence of identical/synonymous words/phrases', and 'similarity between two sentences'. Their result indicates that, in the case of technical Japanese texts, considerable portions of discourse structure can be identified by incorporating the three types of surface information.

Since there are few practical CALL systems that use discourse analysis, the purpose of this study is to develop such a system for helping learners to write technical Japanese texts on the WWW. Section 2 describes the implementation of the system using NLP techniques. The authors took a similar approach to Kurohashi and Nagao [14], namely using surface information in texts. The rules for analyzing technical Japanese texts are based on micro-level (cohesive expressions) and macro-level (headlines) information. Section 3 describes the study that evaluates the effectiveness of the system in two experiments.

2 Implementation of the system

2.1 Method

The combination of cohesive expressions and headlines are employed in the implementation of the system. To examine discourse structure of technical Japanese texts, the classification of basic expressions by Yamazaki et al. [27] is adopted in this study. The reason for this is that their classification covers most of the

elements of technical Japanese texts. Based on their findings, the authors have classified cohesive expressions into 15 categories as follows: *comparison, contrast, analogy, cause and reason, basis, composition and enumeration, presentation, definition, classification, hypothesis and conditions, change of state, process of change, change with prerequisites, means and methods, selection*. The total number of expressions is 82. All of the expressions are converted into regular expressions to make the rules. In all, 654 distinctions in the regular expressions were extracted from the 15 categories of cohesive expressions. These formed 654 original rules, which are used in the process of analysis.

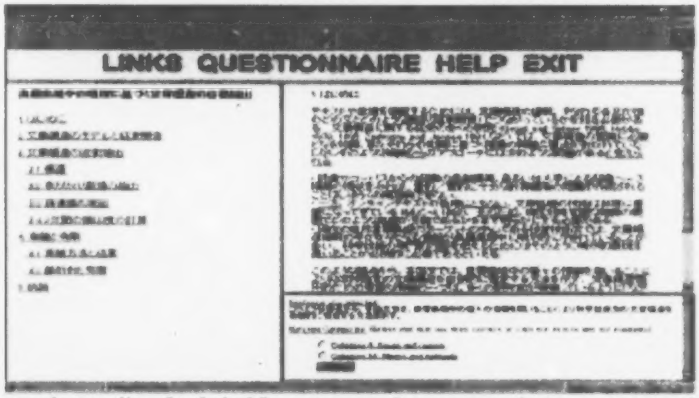
There are two patterns of rules: one is for 'simple pattern matching' and the other is for 'discourse analysis'. The former, called rule set A, is written as a regular expression form and the latter, called rule set B, is written as a regular expression combined with the result of morpheme analysis and syntax analysis. The rule in rule set B is written in a more restrictive form to improve the accuracy of discourse structure analysis. For example, if a sentence is applied to rule set A, it is then analyzed by the morpheme analysis and syntax analysis and the result will be matched to rule set B.

There are many text books on good writing, which nearly all contain a lot of material concerning the different kinds of categories or conceptual bricks at the discourse level out of which texts are built (see, for example, [4][5][6][12][25][26]. However, it is difficult to detect the text structure by just using their framework because it is too extensive and the varieties of different formats used by people for building technical texts too numerous. Instead of predefined framework, headline is used as macro-level information in this study. There are several reasons why the authors decided to use 'headline' instead. First, a well-chosen headline allows the reader to infer the text structure. Second, different formats of texts can be analyzed independently of the texts' style by using the headline. Third, it is easier to understand when the headline is displayed rather than a tree structure because the headline is a part of the original text.

2.2 The discourse structure analysis module

The discourse analysis module of the system contains 'simple pattern matching', 'morpheme analyzer', 'syntax analyzer', and 'discourse analyzer' components. First, the headlines are extracted and the Japanese texts are divided into sentences using several heuristic rules. Then all the sentences in all texts are matched with all the rules in the 'simple pattern matching' component. The 'rules for pattern matching' is used during the process of pattern matching. Because of the exclusive character of almost all of the rules, they are written in order of frequency to reduce the running time on the computer. The frequency of rules is made from the 'rules corpus'. The present system analyzes Japanese text sentences with the morpheme analyzer and syntax analyzer to check the dependency of sentences in the case grammar. Therefore, each cue word in the rules is not only matched against the word itself, but also against the 'parts-of-speech' of the cue word. Only sentences that match the rules written in restrictive form are needed for morpheme analysis and syntax analysis. This takes into consideration the problem of computer running time. The 'rules for discourse analysis' is matched again in restrictive form after the process of syntax analysis. The additional information (parts-of-speech, tense, etc.) is checked to identify the cohesive expressions, especially in the case where one sentence is matched with two or more rules.

Figure 1. One screen shot of discourse structure analysis



The learning page shows a list of technical Japanese texts. Learners can choose any one text by clicking the hyperlink on the list. When learners choose one of the texts from the list, headlines of the selected text are

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analyzed and displayed first to help learners grasp the whole text structure. Secondly, learners can click on the headline of any part of the text that they want to read. Then the original sentences corresponding to the headline are displayed with the extracted cohesive expressions. The cue words in the cohesive expressions are displayed in color to enable learners to focus on it more easily. Learners can click on any cue words to further find out the cohesive expressions corresponding to the sentences. They can also refer to examples that correspond to the cohesive expressions from the 'examples corpus'. Figure 1 shows one screen shot of the system (text source: [14]). As shown in this figure, the headlines of the Japanese text are analyzed and displayed on the left side of the browser. The headlines show the structure of the text. On the right side, the original sentences corresponding to the selected headline are displayed on the upper part with the cohesive expressions extracted and a link made. When the cue word '*kotoniyori*' (in the first line of the third paragraph) is clicked, the matched cohesive expressions are displayed on the bottom right side of the browser.

2.3 System evaluation of the discourse structure analysis module

A system evaluation is conducted to evaluate the performance of the discourse structure analysis module on 24 technical Japanese texts. The system evaluation is designed for text analysis in two stages (pattern matching in Stage 1 and discourse analysis in Stage 2). The analysis consists of 3 items on both stages: *headline extraction*, *cohesive expression extraction* and *frequency of the rules*. The accuracy ratio of the headline extraction in Stage 1 is 95.22% on average. After a heuristic rule is added, the result of the headline extraction using the revised rules in Stage 2 gained an exceedingly high accuracy rate of 99.17%. The accuracy of the cohesive expression extraction in Stage 1 is 70.23% on average. On the other hand, the accuracy in Stage 2 improved to 92.70% on average. This result shows that using the rules combined with morpheme analysis and syntax analysis gained a higher degree of accuracy than only using the rules of simple pattern matching. After the cohesive expression extraction, the frequency of rules is calculated. The result of 'frequency of the rules' is saved to the 'rules corpus'. The order of frequency is taken as the order of the rules to reduce the running time on the computer.

2.4 The system for supporting technical Japanese texts writing

A CALL system is developed to help learners in the writing of technical Japanese texts. The system is implemented in terms of headlines and cohesive expressions, which is based on the method of the discourse structure analysis module. For headlines supporting, a connection between headline and texts corresponding to the headline is made automatically. Learners can click on any headline to immediately link to the content of texts corresponded to it. For cohesive expressions supporting, examples with the selected cohesive expressions are automatically extracted from the corpus of technical Japanese texts. Learners can refer to these examples to help them improve their writing skills.

The flow of the system is as follows:

(1) Learners register themselves to use the system. An ID number is given after registration. The ID number is used to identify the learner because a log of all learning histories is registered during the operation of the system.
(2) The page for headlines input is appeared. Learners can free input their headlines here. When learners completed their construction of headlines, each headline is automatically linked and displayed on the left side of the browser. The left side of Figure 2 shows an example of linked headlines.
(3) When learners choose one of the headlines, a text box is appeared on the top right side of the browser. Learners can compose their texts corresponded to the clicked headline in the text box. The top right side of Figure 2 shows an example of texts input.
(4) When learners click on the 'basic expressions' button on the bottom right side of the browser, the categories of cohesive expressions is appeared on a new page. Each category is classified further into sub-categories. When learners choose one of the sub-categories from the list, examples are automatically extracted from the corpus of technical Japanese texts and the result is displayed on the bottom of the browser. Figure 3 shows that examples are displayed corresponded to the selected sub-category of cohesive expressions.

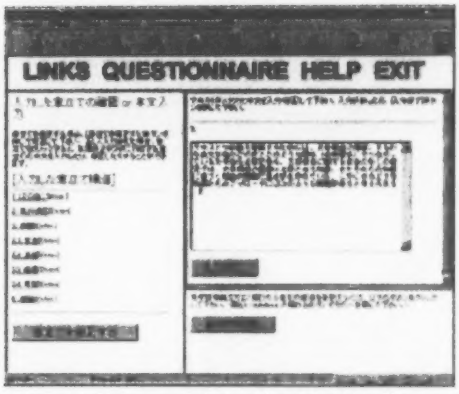

Figure 2. One screen shot of the linked headline and texts input

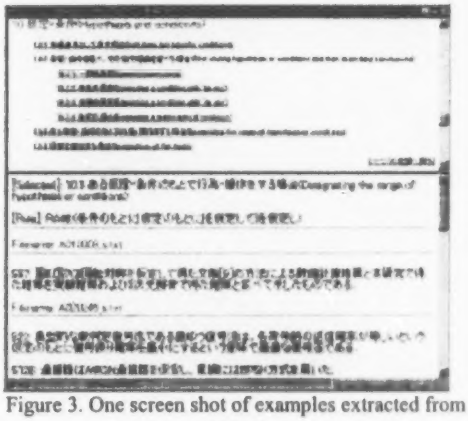

Figure 3. One screen shot of examples extracted from corpus

3 The study

Two evaluation experiments were conducted to examine the effectiveness of the system. The system is evaluated in terms of subjects' intuitive impression and actual usage of the system in the experiment 1 and the experiment 2, respectively. Thirty-three subjects participated in the experiment 1; the other seven subjects participated in the experiment 2. The subjects almost use the WWW and computer everyday.

3.1 Experiment 1

The purpose of the experiment 1 was to examine the functions of the system in terms of subjects' intuitive impression. Therefore, the experiment was designed to make a comparison between the system with the popular and well-known word processor: the MS-Word. During the experiment, the subjects were asked to look at the operation of the system and the MS-Word using video for duration of 10 minutes. The subjects were informed that they would be asked to fill in the questionnaire concerning the comparison of the two systems. The questionnaire consisted of 3 categories: *items of technical sentences writing*, *items of general sentences writing*, and *items of system operation*. The subjects were asked to rate 24 items on a 5-point scale. The subjects were also asked to make comments on the system.

Figure 4 shows the rating of the system and the MS-Word for each item with the 3 categories in experiment 1 and 2. The result of the experiment 1 shows that the system obtained a higher rating than the MS-Word on all of the items of technical sentences writing. For those items of general sentences writing and system operation, the result shows that the MS-Word obtained a higher rating than the system or there was no significant difference on the two systems. However, the system obtained a higher rating than the MS-Word on items 18 ('Sentences can be efficiently made') and 15 ('It is suitable for learning').

Comments on the system are summarized as follows: Almost all of the subjects answered that it is necessary to involve the functions to access other objects, such as figures, tables and numerical expressions, etc. Since the system is emphasized on the discourse analysis of technical Japanese texts using NLP techniques, the target of the system is limited to 'texts'. However, figures, tables and numerical expressions are important components of technical texts. Therefore, development of such visual tools for supporting these objects is expected.

3.2 Experiment 2

The result of the experiment 1 suggests that the system is preferred to the MS-Word on technical texts writing. However, actual usage of the system is not evaluated. Therefore, in order to examine the effectiveness of the system in terms of actual usage of the system by foreign students, experiment 2 was conducted. During the experiment, the subjects were asked to compose a technical Japanese text using the system. The subjects were asked to write sentences concerning their specialization instead of a given task because a variety of subjects' different fields. After the composition is completed, the subjects were asked to fill in the questionnaire concerning the comparison of the system and the MS-Word. The questionnaire is identical to experiment 1, which is divided into 3 categories. Finally, the subjects were interviewed based on

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their response to the questionnaires.

From Figure 4, the result of the experiment 2 shows that the system obtained a higher rating than the MS-Word on all of the items of technical sentences writing, which is consistent with the result of experiment 1. For those items of general sentences writing and system operation, the result shows that the subjects preferred the system, or the MS-Word or there was no significant difference on the two systems. Comparing this result to experiment 1, the system obtained a higher rating than the MS-Word on items 18 ('Sentences can be efficiently made') and 15 ('It is suitable for learning'), which is consistent with the result of experiment 1. On the other hand, some items obtained different result between the two experiments. These items can be divided into 3 types: First, items 7 ('I want to recommend it to my friends') and 24 ('I want to use it more') are rated from 'no significant difference' to 'a higher rating to the system'. Second, item 2 ('It is friendly') is rated from 'a higher rating to the MS-Word' to 'no significant difference'. Third, item 11 ('It is easy to see') is rated from 'no significant difference' to 'a higher rating to the MS-Word'.

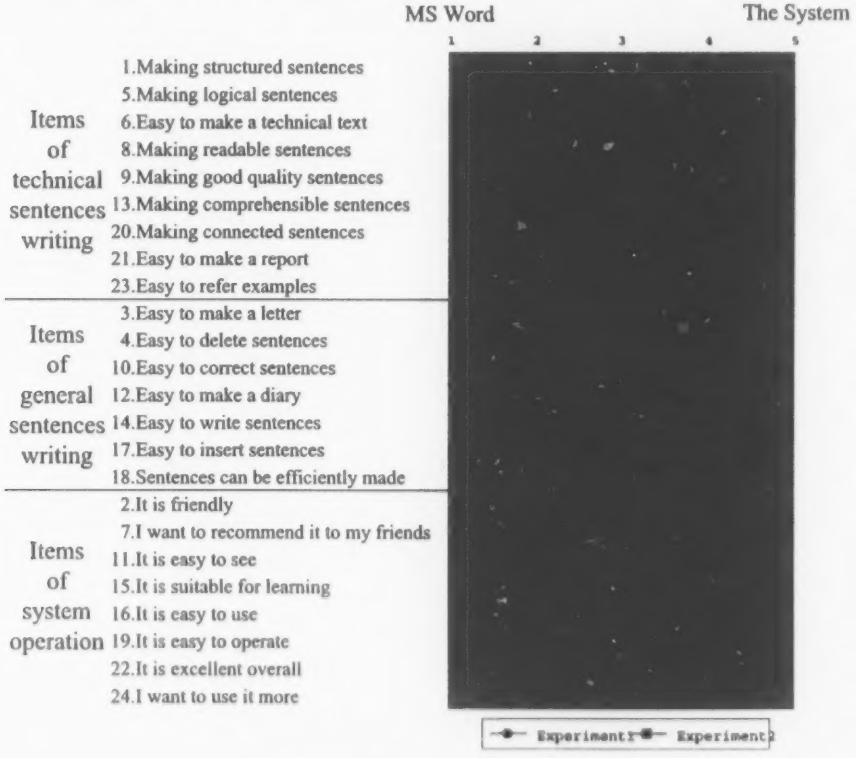

Figure 4. The rating for each item in Experiment 1 and 2

The subjects were asked to give reasons for their responses to the questionnaire items during the interview. The result of the interview concerning the functions of the system is divided into 4 types and summarized as follows: First, for automatically analyzing and displaying headlines, almost all of the subjects answered that it is very useful because they can click on any headline to immediately read the content of texts corresponded to it. The subjects also answered that headlines can be treated as an important role to help them to grasp the whole structure of the texts. Second, for automatically analyzing and displaying cohesive expressions, almost all of the subjects answered that it is very useful because they can find it is easier to convey their thoughts using explicit cohesive expressions. The subjects also answered that it is easy to find their errors because cohesive expressions in the texts are highlighted. Third, for referring to examples from corpus, almost all of the subjects answered that it is very efficient to writing because they can save a lot of time for finding examples from other references. The subjects also answered that they can imitate and learn more examples from the output of corpus. They can learn very much from the process of referring to examples in different texts, especially if there are many different usages in an expression. Fourth, for

Japanese language learning, almost all of the subjects answered that the system is suitable for learning because the system supports learners to learn technical Japanese writing in a structural way in terms of automatically analyzing and displaying headlines and cohesive expressions in technical Japanese texts. The subjects also answered that they can learn not only new cohesive expressions but also correct usages of cohesive expressions even they already know one of them.

Other comments on the system are summarized as follows: Almost all of the subjects answered that it is desired to improve the system to support the functions of electronic dictionary, thesaurus, grammar checking, etc. Therefore, construction of a good electronic dictionary for technical texts writing is considered as an important issue. Moreover, some subjects answered that it is better to extract examples form corpus according to learners' specialization than only random accessing to the corpus. From this result, constructing a corpus should not only consider the number of texts but also the balance of texts in each field.

4 Conclusion

In this paper, the authors describe the development and evaluation of a CALL system for supporting the writing of technical Japanese texts on the WWW. To analyze discourse structure of technical Japanese texts, the rules for analyzing texts are based on micro-level and macro-level information, namely cohesive expressions and headlines. A CALL system for helping foreigners to learn to write technical Japanese texts has been developed using NLP techniques. The system has the following functions: automatically detecting headlines and cohesive expressions in technical Japanese texts, displaying this information on the WWW, and extracting examples from the corpus of technical Japanese texts. The results of a system evaluation show that the system obtained a high degree of accuracy on extraction of cohesive expressions and headlines by using the revised rules set proposed in this study.

The results of the study show that the instructive effectiveness of the system. The result of the interview also shows that the system is not only suitable for technical Japanese writing but also for Japanese language learning. Based on the functions of the system, these results can be explained as follows: First, headlines can be treated as an important role to help learners to grasp the whole structure of the texts. Second, cohesive expressions often explicitly appear in the surface expressions of technical Japanese texts. Thus, it seems important and necessary to use these explicit cohesive expressions to structure one's thoughts in technical Japanese texts. Foreign learners especially may find it is easier to convey their thoughts using explicit cohesive expressions because these can be treated as an indicator of a discourse. Third, the corpus consists of the actual usage in technical Japanese texts from different fields. Instead of predefined examples, examples are automatically extracted from the corpus. Therefore, learners can learn very much from the process of referring to examples in different texts if there are many different usages in an expression. They can also save a lot of time for finding examples from other references.

In conclusion, the system is suitable for learning because the system supports learners to learn technical Japanese writing in a structural way in terms of automatically analyzing and displaying headlines and cohesive expressions in technical Japanese texts.

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Development of Japanese-English, English-Japanese Conversation System with Voice Reading and Machine Translation

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1 Research Background

In recent years, the internationalization of Japan has attracted many foreigners. But, in the present state we have seen mostly people are shy to speak to foreigners because they cannot speak foreign languages. Again, there are many attempts that enable one to communicate on the Internet. In a preceding research, there was an attempt to add word translation to word chatting function (refs.[1]). Besides in any communication plurality of media help in the understanding (refs.[2])(refs[3]). For examp le, there was another preceding research that showed that listening along with subtitling in the same language help understand the content in the foreign language education (refs.[4]).

2 Research Objectives

In this research, therefore, we have developed a conversation system, which uses machine translation and text reading in the networking environment. This system uses machine translation, which enable people to communicate between two different languages. And, it fulfills text-reading function of chatting to help understand conversation contents

3 Developmental Environment

This system is developed with "Microsoft VisualBasic 6.0". The Japanese-English translation engine of this system used "LogoVista E to J ver 5.0 "and the English-Japanese translation engine used "LogoVista J to E ver1.1". Japanese Voice synthesis engine is "IBM ProTalker 97", and English Voice synthesis engine is Microsoft Agent.

4 Outline of Developed System

In this system, when we input Japanese or English, we can get Japanese text or English one and its rendering text and voice synthesis of its rendering one.
The steps from the text input to the translation, and the voice output is shown as follows.
(1) Sentences, which the client inputs, are passed to the server.
(2) These sentences are then passed to the translation engine, and the server translates in English in case of

Japanese input and vice versa.

(3) The server sends translated sentences to both client and the other party.

(4) Translated sentences are indicated after input sentences on the receiver side, and translated sentences are displayed along with basic input on the other party side.

(5) If translated sentences are in Japanese, its voice output is given using "IBM ProTalker 97"(refs[5]) If it is English, then the output is given using "Microsoft Speech API"(refs[6])

5 Evaluation Experimentation

Three pairs consisting of one Japanese speaking person and one English speaking person were considered and experimented on the different setup. Type one is not using machine translation. Type two is using machine translation. We administered a free response type questionnaire for collecting data regarding the feeling of the participants during the different sessions. From the result the interest concerning learning of foreign language came up, and the participants' opinion of being able to take part in the conversation, not being aware of talking with foreigners using machine translation, were very positive. The pictures dawn by subjects with two different conditions are shown as the follwing.. The condition with word chatting not using the machine translation module. The left picture shows the picture which the sender want to send, and the left drawings shows the picture drawn by the receiver with the above condition.

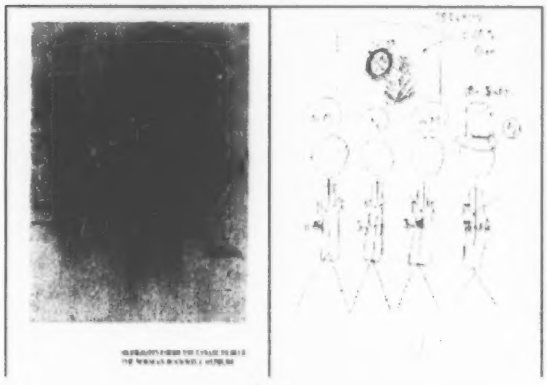

Fig.1

The condition with word chatting using the machine translation module. The left picture shows the picture which the sender want to send, and the left drawings shows the picture drawn by the receiver with the above condition. We can compare two pictures drawn by the receiver under the two conditions. As a result, we may roughly estimate that the picture using the machine translation module shows more precise information than the picture without the machine translation. As the above differences are based on a quite subjective judgment, it is not conclusive. Though the difference seems to be apparent from the view of quantities of sending information, we can't find the specific reasons caused the differences. The system developed with the chatting using the translation module will work effectively, especially to the persons who want to communicate each aother.

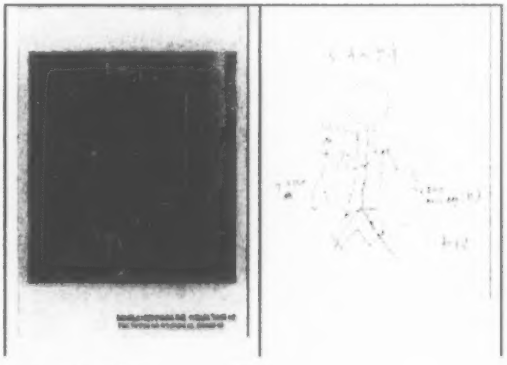

Fig.2

6 Future Works

We are now planning to expand the scope of speech recognition system as the future works. We have been introducing the speech recognition module to our system, and we are now evaluating the effectiveness of the speech recognition module to enhancing the communication.

Acknowledgement

The authors would like to thank Dr. Madhumita Bhattacharya in National Institute of Multimedia Education for her great assistance.

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Development of the *ELT in Taiwan* Web Site for English Learning and Teaching

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English learning involves both knowledge acquisition and skills automatization. On the other hand, the potential of Internet lies not only in a large quantity of information display, storage, and updating, but also in computer mediated communication (CMC). The two functions, knowledge base and electronic communication, match the dual processes of English learning: knowledge and use. The educational Web site, *ELT in Taiwan*, was constructed under such a theoretical view of English learning. Additionally, teacher professional development is another key consideration for the design of the Web site. With the new generation of Web objected oriented (WOO) software technology, synchronous CMC can be built with traditional Web sites together while keeping its feature of multimedia, text and graphics-based virtual reality for multi-users on-line synchronously. The knowledge-based Web site has a *Teacher Development* component, and a synchronous WOO, called *ForMOOsa*, implemented with a high school metaphor. *ELT in Taiwan* was also constructed to meet local needs of its target users, both teachers and students in Taiwan. The paper demonstrates how we incorporated the features mentioned above and what has been constructed so far.

Keywords: **MOO, Web, English learning and teaching, Teacher development**

1 Introduction

The number of the World Wide Web (the Web) sites increases exponentially nowadays. In additional to electronic commerce, electronic services, or electronic information, the Web is also a powerful educational medium or virtual space for e-learning. Universities start to deliver their courses via the Web because they save students' travel expense from afar, and allow much more students enrolling at the same time—because the Web course can be given in a classroom-less environment. Many well-designed Web sites with good-quality materials exist in English-speaking countries, and have been used for some time. The author [1] has asked college juniors in Taiwan to read the articles at the CNN site and write a response journal entries regularly. It was found that students improved in both English reading and writing performance via this activity. However, it was also found that American culture in the CNN news stories was not immediately comprehensible to college junior English majors. Guidance is needed when teachers try to use informational Web sites for English teaching. Even with English learning sites, the information there designed specifically for learners, not general users, still poses potential problems for learners in Taiwan, Republic of China (ROC)[2]. There is thus a need to design Web sites more appropriate for local needs. In Taiwan some Web sites have been developed. However, most of them are unsatisfactory from the English learning and teaching perspective. The paper describes the development process of a new Web-based English learning project that bridges English learning theories and practices.

2 Theoretical underpinnings

The most relevant theory to English teaching and learning seems to be second language acquisition (SLA) and Vygotsky's sociocultural theories. In this project, it is further believed that English teachers play a

crucial role in the advancement of English Learning and Teaching (ELT) in Taiwan and teacher education/development has not been systematically investigated in the past [3]; thus, a section on English teacher professional development is presented.

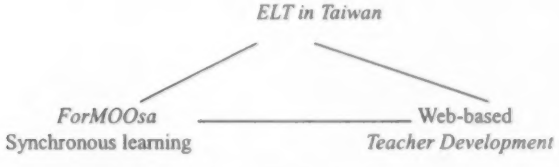
English learning involves both knowledge acquisition and skills automatization; its effectiveness requires improvement in terms of both competence and performance [4]. Skills automatization, related to notions such as control processing, accessibility, or performance, means to package bits of knowledge about English or a second language (L2), and to produce the entire package at a time without using extra cognitive resources to do psycholinguistic on-line compilation such as arrangement of word order. A learner may acquire a great amount of knowledge about English language and culture, and of the knowledge about the world. Still, he needs opportunities to use English in order to automatize the knowledge with adequate fluency, appropriateness, and appropriation. The more recent language learning theories emphasize the social construction of knowledge, notably Vygotsky's sociocultural theory [5]. Language learning is not only a cognitive task but more of a social activity where the process is participating in a knowledge-building community, a community of practice, or a community of second language learners.

Liou [6] addresses four types of myths existing in Taiwan concerning teacher education and points out that professional development using skills such as action research, or reflective practice [7,8] is a solution. New perspectives on English teaching or learning, theoretical development, or updated research findings are essential for a profession to advance. If teachers cannot become researchers themselves, do not conduct action research, care nothing but daily practice, everyone can teach. Often in Taiwan teaching is always one's last choice as soon as he or she retires from other professions. I think teaching is and should be regarded as a respected profession which requires education and cultivation and lifelong development to make teaching perfect. Teachers play the most important role in the ELT field and we need explicit teacher education discussion forum and research (investigating what teachers know, believe, value, and do) in Taiwan. The Web site, *ELT in Taiwan*, is a first step toward the goal.

3 Overall design

Although for advanced English learners, learning English and using it can mean the same thing. For beginners or intermediate learners, and for convenience of implementation, the design of the Web project, called *ELT in Taiwan (台灣英語教學園區)*, is divided into two components: a knowledge base for both English teachers and learners, and a dynamic synchronous CMC environment for English language use, namely, *Teacher development* (TE) and *ForMOOsa* as shown in Figure 1. The TE acts like a knowledge base of English teaching and learning where both teaches and students can visit to acquire updated knowledge about English to meet their own needs.

Figure 1. The framework of ELT in Taiwan



The current *TE* component has ten topics and 6 sub-topics:

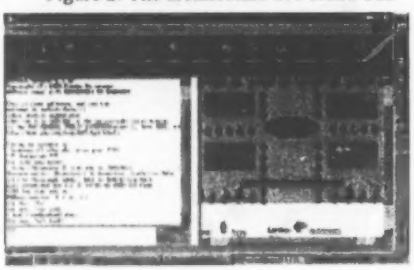
1. Instructed second language acquisition
   a. acquisition process and stages
   b. individual differences
   c. teacher education and professional development
2. New perspectives on English teaching and learning
   a. learner autonomy
   b. sociocultural theory
   c. critical pedagogy
3. Teaching of listening and speaking
4. Teaching of reading and writing
5. Teaching of vocabulary

6. Teaching of grammar
7. Teaching of culture
8. Teaching English in primary schools
9. English assessment
10. Computer assisted English teaching on the Internet

Most of the ten topics have (1) a brief introduction of the field, (2) an updated reference list, (3) examples of teaching materials, and (4) links to relevant sites. In the introduction, we provide brief but updated information about the field so that pre-service and in-service teachers can obtain an idea about the topic. In the reference list, we try to include seminal and updated sources for further reading. In some of the entries, we add an annotation so that readers can obtain a clearer picture of what the source contains. In the material example part, we show teachers what they can design to teach a specific area by providing ready-made on-line lesson. The lesson can be used by learners of different levels to acquire the knowledge about English on-line. The hyperlinks to relevant sites are selected based on our review with brief comments on the site itself. *ELT in Taiwan* so far uses mainly texts and graphics to present information; in the near future, we will incorporate audio and video as they are necessary.

Learners of English usually do not acquire English simply by obtaining the knowledge about the language; they need practice or opportunities to use the language in meaningful contexts for real purposes with genuine audience or interlocutors. This is where computer-mediated communication can play a crucial role. It is also this rationale of language for use and communication that we design the *ForMOOsa* synchronous environment based on graphics and text-oriented virtual reality. Some MOO (multi-user dimension/dungeon Object-Oriented) stations have been constructed in the North America, but none exists in Taiwan as far as we know. Often it takes great efforts and time to link to a site across the Pacific. Most of the time, the culture is alien to students in our country. It is practical and meaningful to construct a MOO of our own in Taiwan. In terms of computer technology, synchronous CMC has been implemented mostly at the telnet platform, instead of the Web's universal protocol. With the new generation Web-based MOOs (WOOs) software technology [9], synchronous CMC can be built with traditional Web sites together with the database such as enCore, an operating system-Red Hat Linux, and a server-LambdaMOO. The synchronous WOO, called *ForMOOsa*, is implemented with a high school metaphor which is simulated like text and graphics-based virtual reality. Its major architecture looks like Figure 2.

Figure 2. The architecture of *ForMOOsa*



It was constructed to address the local needs. The benefit for real audience is that the on-line learning environment will not be constructed with no specific users in mind. We plan to use *ForMOOsa* in a vocation high school in September as it will be incorporated in an "English teaching in the Internet" regular course. The targeted institution is a highly technology-enhanced school which is believed to become prevalent in our country soon. At its first stage of development, we built a virtual senior high school/vocational school on-line with classrooms, dormitory, exhibition hall, and a Cafe with a variety of objects appropriate in each area. Within the dormitory, we have a reading lounge with some legends of Taiwan, "Aunt Tigress", "Hsinchu Holy City Mayor Saved the Prince", and "The Legend of Hero Liaw Tien-Ting". MOOers can explore how the stories develop by reading the entire story, or choose to play interactive dialogues with parts in the stories such as Mandy, Liaw, or Holy City Mayor. The parts, bots or robots in the system, can pick up users' key words in questions and give corresponding responses. Another two bots, Jack and Lisa were created in the Café where they may talk to each other if MOOers activate them. The simulated dialogues are very useful for English learning as meaningful and communicative practices. By August 15 of 2000, we have completed three topic in the *teacher development* unit, "Teaching English in the Primary School," "English assessment", and "Teaching of grammar" (see http://TaiELT.fl.nthu.edu.tw/English/welcome.html);

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and the prototypical framework of *ForMOOsa* (http://formoosa.fl.nthu.edu.tw:7000;) with some objects and bots. For the "Teaching English in the Primary School" unit, an updated English teaching view was adopted, namely, communicative language teaching, where use of English, instead of knowledge about English such as grammar and vocabulary, is emphasized. For instance, in the teaching mateiral section, *The Story of Santa Claus*, was designed with three types of Santa from different foreign countries. The aim is for learners to express some actions by Santa such as climbing in the chimney or giving presents, and to become aware of the fact that Santa is part of culture as Santa is different in different cultures.

4 Conclusion

As illustrated in this project, it is argued that the design of a Web site needs to address its audience needs by bridging theories and practices. Teacher professional development is as important as student learning of English. A local Web site should address its user needs. *ELT in Taiwan* has been devoted by a group of part-time members with limited time in five months. Given longer time, in the future, we plan to incorporate more advanced technologies and instructional design strategies so that we can contribute to the international academic forum.

Acknowledgement

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Integrating Web-based Materials into Course Design

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1 Introduction

This paper is a report on a project in which Web pages were crucially incorporated in the design of a new college course titled anguage and Culture in Taiwan." There were two main reasons for making the Internet an integral part of the course: (1) the wide range of topics covered in this very general introductory course requiring the wealth of information sources easily accessible on the Internet and (2) necessity of frequent updates of information due to the fast and volatile nature of the political evolution in Taiwan, particularly during the presidential election year when this course was offered. The consideration of user factors was also important. The Internet responds well to today's college students who demand relevance (of issues that pertain to the here and now) and immediacy, and are as adept in clicking on the keyboard surfing the Internet as flipping the pages of a book.

More serious, though, in our course design is the educational philosophy that a college's mission is not so much to transfer knowledge as to create environments and experiences that bring students to discover and construct knowledge for themselves [1]. Exposure to the vast amount of knowledge on the Web necessitates focus and careful choice of relevant materials. As part of course assignments students were expected to present on topics of their choice. This ensured that they researched the subject matters in greater depth before presenting them in class, as they would be presenting to an audience of their peers.

2 Method and content

The ready accessibility of the Internet for both the students (practically all students have a PC) and instructor (to add to or update the course page), especially outside of class, altered in-class activities from those of traditional teacher-centered instruction to student-centered discussion and presentation. The utilization of e-mail also facilitated out-of-class preparation. Students were informed by e-mail to go to a certain new site or link for a new development of events. Similarly, the student e-mailed the instructor for information or help. The more out-of--class preparations the students have, the better the quality of in-class discussions the instructor can expect.

The syllabus was essentially a structure of links organized according to the class schedule of topics and activities. It is also a display of the scope and structure of the contents of the course. It changed dynamically as new links were discovered and added throughout the semester. The syllabus appears as a navigation bar. To facilitate learning we have minimized visual search by displaying this syllabus bar consistently on top of each page[2]. Students can easily navigate from site to site, not only to preview but also to review. Besides a general page of topics with their links to available Web sites, the page of each session further highlights some particular links to topics of the session, along with a list of references available on reserve in the library.

The contents of this course consist of two major areas: (1) culture and (2) language. The former includes a wide range of topics, such as a profile of Taiwan, history, political parties, customs, festivals, family relations, literature, world view of Taiwan, and the future of Taiwan. Generally each topic or a group of related topics was covered at a weekly session, which lasted two and a half hours, of which the first half was devoted to cultural discussions and the second half, instruction of language. The culture part of the course

was conducted in a seminar format along with presentations by students.

By dividing the content area into culture and language, we were not forgetting that language always operates in a culture [3]. Besides teaching phrases and sentences applicable in social situations, other aspects of the language, such as kinship terms, nursery rhymes, proverbs, songs, etc., abounding with traditions and cultural values, were also taught. The language part of the course contained sound files. Some had two types of reading, a slower one and a faster one, to facilitate learning. Taiwanese expressions in each language lesson generally contain both literal and free translations. This makes self-study very easy and convenient, as long as they could access the Web. Sound files were indispensable as Taiwanese is a tone language and furthermore has seven tones and possesses an elaborate tone sandhi system [4].

This Web program was produced entirely in the instructor's office by using Netscape Composer, SoundRecorder, and other freeware downloaded from the Internet [5]. The exercise part of the course, which features filling in of blanks, multiple choice, short answer, etc., was made possible by the ExTemplate program developed at Rice University Language Resource Center [6]. The ExTemplate application creates exercises that will be stored in a database for future retrieval [7]. It allows students to submit exercises via the Internet and be graded by the instructor also via the Internet. The language lesson sound files were integrated into ExTemplate. This feature was very useful particularly for tonal distinction exercises.

Our classroom was equipped with a multimedia Podium which allowed us to go on the Internet, show videos, movies, documents, play CD , etc. The Podium came in handy when a demonstration on the classroom screen was called for. Not only did the instructor use the Podium, students were encouraged to do their class presentations by using PowerPoint or by going to their own personal homepages where they collected Web links or images related to their topics for classroom presentation.

3 Conclusions

By incorporating the Internet into course design, we were able to create a more accommodating learning environment for the students and to give students more control over the learning process. As this was our fist attempt at teaching the course with Web-based materials, further refinements of many aspects of the course need to be made. For example, we can make pages less cluttered with text and add more digitized videos. Also researches can be conducted to determine students' reactions in terms of attitudinal factors and learning efficiency. Taiwanese on the Web is an on-going project. We solicit help and comments. This project attempts to raise awareness in the global community of the vitality of a culture less known and rarely covered in college courses. As universities generally suffer from budget constraints, by making this program available on the Web we hope to encourage teaching of this subject matter.

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Agents in a WWW System for Academic English Teaching

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This paper describes our research on building a free, evolutionary, Internet-based, agent-based, long-distance teaching environment for academic English. Here we will describe some of the design aspects of the system prototype, focusing especially on the adaptive features and the agents of the system.

Keywords: **Distance Education, CALL, Agent Technology**

1 Introduction

As distances constantly grow smaller and the Internet links more and more remote parts of the world, English gradually becomes the lingua franca for information exchange. In the academic field, in research and development, where international cooperation is a must, English is used frequently. Academic English is International English. Although accents are more or less variable, the spoken, but mostly, the written academic language has still its rules and etiquette. Academics usually know some English and have a more or less wide English vocabulary. However, especially in Japan, but in other non-English speaking countries as well, there exists the phenomenon that, although a person can read academic papers in English, when it comes to writing a paper by oneself, or to make an academic presentation in English, serious problems appear. Therefore, we embed these necessary rules and etiquette in our teaching environment. The main aim of our system is to help academics exchange meaningful information with their peers, through a variety of information exchange ways: academic homepages, academic papers, academic presentations, etc. As far as we know, this type of English teaching system is new. Some English teaching environments on the Web appeared, but, as in [1] or [11], they have two main defects: they are not free, and/or they are not automatic, but based on real human teachers at the end of the line. Good on-line dictionaries [12], [8] and several collections of English on-line books [2] exist, but those can only act as auxiliary helpers during the English learning process. Our aim is to have a system capable to function autonomously, without human interference, as a virtual, long-distance classroom, embedding the necessary tutoring functions within a set of collaborating agents that will serve the student. The course is called 'MyEnglishTeacher', because of its evolutionary nature, of adapting over time to the needs and preferences of individual users. These needs can be expressed explicitly, or can be implicitly deduced by the system, represented by its agents. We are currently in the process of adding more AI-based intelligent adaptation capabilities. Users can find in our virtual classroom situational examples of academic life, presented as Multimedia, with Audio and/or Video presentations, Text explanations and pointers to the main patterns introduced with each lesson, exercises to test the user's understanding, moreover, adaptive correction, explanation and guidance of the user's mistakes. The general guidelines for this system were proposed by our course design researcher in [3] and elaborated by us in [6].

2 Background

Virtual environments in education and distance-learning systems are the recent trends in education worldwide. This trend is determined by the current spread of the Internet, as well as by a real demand for better, easy-to-access, and cheaper educational facilities. Therefore, universities everywhere respond to the academic demand for technological and pedagogical support in course preparation, by developing specialized software environments [5]. As bandwidths grow, the traditional text environments gradually switch to multimedia and Video-on-Demand (VOD) systems ([17]). The problems in the current language

education systems, as well as the motivation of our research, as pointed out by our language specialist team member and [15], can be resumed as follows: the lack of learning activities for checking learners' constructive understanding (requiring the learner not only to memorize, but also to summarize, generate, differentiate, or predict); the lack of a variety of problem-solving tasks to motivate students to think about their reading; the learning process does not enable learners to become active participants; in the current Computer Aided Language Learning (CALL) systems, learners cannot key-in the target language's sentences freely; lack of explanatory feedback (telling the user why); lack of exercises related to the learner's individual characteristics; lack of considerations about the effectiveness of different physical attributes of the presentations, on the students' learning; lack of analysis of the interaction between learner and learning environment, with special focus on assimilation and accommodation. These problems could not be solved by traditional systems, mostly due to their lack of adaptability, or in other words, intelligence. In [19], it is stated: "there is the need to endow these systems with the ability to adapt and learn, that is, to self-improve their future performance". The objective of this research is to help learners achieve academic reading and writing ability. The course is intended for students whose starting English level is intermediate and upper-intermediate, who have some vocabulary of English, but not much practice in using it. The tutoring strategy used is to give the reader insight into his or her implicit or explicit learning strategies. The methodology applied is the communicative teaching approach, allowing communication and interaction between student and tutoring system, via agents. The interactive reading strategies applied and yet to apply include bottom-up theory, top-down theory, and schemata theory. The topics and stories used are mainly passages from textbooks, journals, reference works, conference proceedings, and academic papers, in other words, real-life academic products.

3 System features and modules

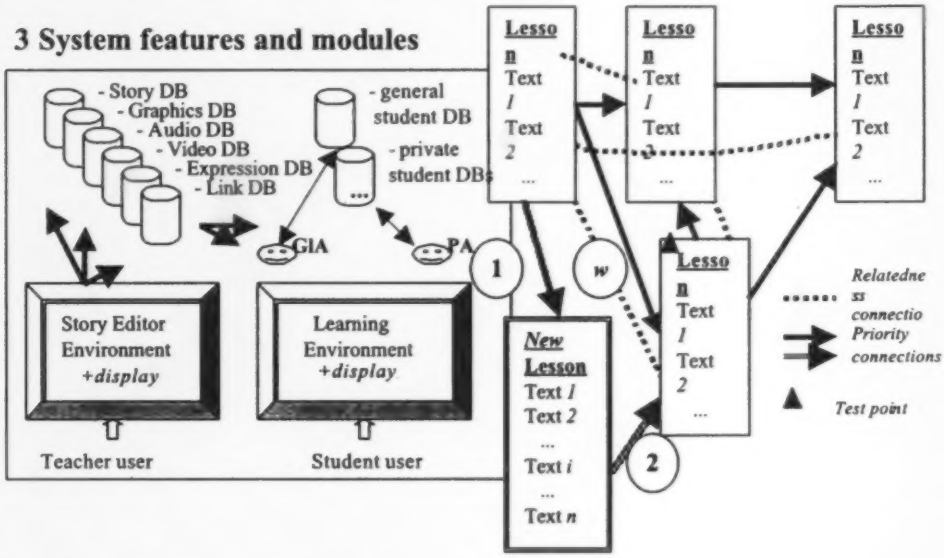

Fig. 1: The system modules and their interaction

Fig. 2: The subject link database

The system offers two interfaces, one for the teacher/tutor user, for course-authoring purposes, and the other one for the student user, who is supposed to learn. The information exchange from tutor to system contains input of lessons, texts, links between them, etc., but also asking for help in editing. The data from the tutor is stored in six different structured databases, including a library of expressions that appear in the text, a VOD database, a background image database, an audio database of listening examples, a full text database and a link database. The information exchange with the student is more complex. It contains usage of the presented materials, implicit or explicit advice, the student's advice requests, queries, searches, gathering of data on the student by the two agents, the Global Agent (GIA) and the Personal Agent (PA). Each of these agents has its own database on the student(s). The GIA stores general features on students, and the PA stores the private features of each student. User modeling follows many patterns, and has many applications. [7] proposes a fuzzy-based, stereotype collecting user model for hypermedia navigation. [18] elaborates on the Human Plausible Theory. ([4]) provides intelligent help for determining the cause of errors in software usage.

[14] has shown how prior belief (belief bias) can influence the correctness of judgment of the human (users). Other authors, like [10] have studied the relation between achievement goals, study strategies and exam performance. A realistic user model has to take into consideration the influences a system can achieve on the user, in order to allow an easy interpretation of the current state, as well as an easy and clear implementation of the user model.

4 The Authoring System Module (Story Editor)

Our most important goal is to design a meaningful, evolutionary feedback for the user. In order to build such a
system, an authoring tool is necessary for flexibility purposes: our colleagues researching the optimal material for academic English teaching should be able to add or delete freely the available resources. In a way, they are also clients/users, and should be restricted to build a courseware, which conforms to the capabilities of the system. In the following, these restrictions and their purposes are explained. These restrictions are necessary instruments for the two system agents to work with, as will be shown later in this paper.

Texts: Each video/audio recording has to have a corresponding TEXT (of dialog, etc.). For each text, it is analyzed if video is necessary, or if audio suffices, as audio requires less memory space and allows a more compact storage and a speedy retrieval. Each TEXT also has (beside of main text, etc.), the following attributes: a short title, keywords, explanation, patterns to learn, conclusion, and finally, exercises. Titles and keywords are naturally used for search and retrieval, but the explanation and conclusion files can be also used for the same purpose, as will be explained later on.

Lessons: One or more TEXTs (with video or not) make up a LESSON. Each LESSON also has (beside of texts, etc.) the following attributes: title, keywords, explanation, conclusion, combined exercises (generated automatically or not). Next, a text or a lesson will be referred as 'SUBJECT'.

Priority and Relatedness Connections: When introducing one or more subjects, the teacher has to specify the Priority Connections, i.e., to show the required learning order, with a directed graph (arrows). When there is no order, subjects will have the same priority, and build a set. The teacher (courseware author) should also add connections between related SUBJECTS, with indirect links. This means, the teacher has to add Relatedness Connections between subjects, for which no specific learning order is required, but which are related. These relations are useful, e.g., during tests: if one of the subjects is considered known, the other one should be also tested. The main differences between the priority connections and the relatedness connections is that the first ones are directional, weightless connections, whereas the latter are non-directional, weighted connections. After these priorities and links are set, the system will then automatically add more links via keyword matching, from explicit keyword files and keyword search within subjects. Priorities among the texts of a lesson are set implicitly according to the order of the texts, but can be modified, if necessary. The teacher / multimedia courseware author can decide if it is more meaningful to connect individual texts, or entire lessons, for each lesson. The way a new lesson is introduced, by asking the teacher to set at least the previous and the following lesson in the lesson priority flow, is shown in figure 2 (steps 1,2). As can be noticed from figure 2, priority connections, with no respective relatedness connection, can exist. This can happen when, e.g., common course design knowledge dictates that respective priority, but the learning contents of the lessons are quite different. These kinds of priorities are optimal student learning strategy related connections, not similar contents connections. These priorities help the system to place the current subject in the global subject map. Final priorities will be set by the system according to findings (teacher's input, keyword matching). This final result can be shown to the teacher or not, depending on the options under which the system is running. We are currently testing if it is wise to allow the teacher to have add/modify/delete rights. The final graph is used for the student, and it can be shown to the student upon request, serving as a map guide.

Numbering: SUBJECTS are numbered automatically in the order of their creation. Teachers are prohibited to use numbering. This is because otherwise, every time new material is brought, the numbering should be changed according to the new order of priorities. TEXTs are automatically numbered inside a lesson, and are referred from outside with two numbers: the LESSON number and the text number.

Test Points: The teacher should mark TEST POINTS (figure 2), at which it is necessary to pass a test in order to proceed (these tests can be at any SUBJECT level).

5 Student models and agents

The system gradually builds two evolutionary student models: a global student model (GS) and an individual student model (IS), managed by two intelligent agents: the personal agent (PA) and the global agent (GlA).

The reason for doing so is that some features, which are common to all students, can be captured in the GS. However, many studies have shown [17] that personalized environments and especially, personalized tutors, have a better chance of transferring the knowledge information from tutor to student. This is true even in the more general sense of a tutor and student, where the tutor can be man or machine, and the student likewise. In this work, we mean by agent a "computer system situated in some environment", "capable of autonomous action", "in the sense that the system should be able to act without the direct intervention of humans", "and should have control over its own actions and internal state" [13]. These agents' intelligence is expressed by the fact that each agent "is capable of flexible autonomous action in order to meet its design objectives", and that it is "responsive" (it perceives its environment), "proactive" (opportunistic, goal-directed), "social" (able to interact) [13], and of an "anticipatory" nature (having a model of itself and the environment, and the capability to pre-adapt itself according to these models) [9]. Next, the raw data stored for the two student models, the GS and IS, is presented.

The GS: The GS contains the global student features: the common mistakes; favorite pages, lessons, texts, videos, audios, grading of tests' difficulty (according to how many students do each test well or not); search patterns introduced, subjects accessed afterwards: if many IS use the same order, than they are recorded in the GS.

The IS: The IS contains the personal student features: the last page accessed; grades for all tests taken, mistakes and their frequency; if the student takes the test again and succeeds, his/her last grade is deleted, but his/her previous mistakes are collected for future tests; the order of access of texts inside each lesson; order of access of lessons (this can be guide to other students: "when another student was in your situation, he/she chose..."); frequency of accessing texts/ lessons/ videos/ audios, etc. - for guidance and current state check; search patterns introduced, subjects accessed afterwards (to link patterns with new subjects that the system didn't link before).

The PA: The role of the personal agent is to manage the information gathered on the user, and to extract from this information useful user guidance material. Each step taken by the user inside the environment is stored, and compared with both what was proposed to the user, as well as with what the user was expected to do (from the PA's point of view). The differences between previous expectation and current state are exploited, in order to be used for new guidance generation. Beside of analyzing the own user and extracting knowledge from the data on him/her, the PA is able to request information from the GIA, about, for instance, what other users chose to do in a similar situation to the current one of the PA's own user. Furthermore, the PA can contact other PA's with similar profiles (after a matchmaking process), and obtain similar information as from the GIA, only with more specificity. The PA can decide to turn to another PA if the information from the GIA is insufficient for a decision about the current support method. The PA decides, every time a user enters the system, what material should be studied during that particular session, and generates a corresponding list. Therefore, the course index is dynamic, not static. To this material, the PA will add or subtract, according to the interaction with the user during the session. According to [16], the PA is therefore an interface agent ("a computer program to provide assistance to a user dealing with a particular computer application" – in this case, a learning environment). However, the PA's job description is a little wider than this, as can be seen also in the following.

The GIA: The global agent averages information from several users, to obtain a general student model. The deductions of the global agent are bound to be non-specific. The GIA is necessary, because otherwise, the system will not profit from the fact that different users interacted with the system, and each new interaction can smoothen the path for following users. The GIA is to be referred before the PA starts looking for information from other PAs, process that can be more time-consuming. Therefore, the role of the GIA is to offer to the PAs condensed information, in an easily accessible, swiftly loadable form. From this description, it is clear that the GIA is subordinate to the PA (from the student user's point of view). The GIA cannot directly contact the student user – unless the PA explicitly requests it. If the GIA considers that its intervention is required, it still has to ask for permission from the PA. In this way, the generation of confusing advice is avoided.

From the described interactions between agents and databases, and between the agents themselves, it is clear that the agents of the system work in two ways. The first way is based on the embedded rule/knowledge systems, which try to foresee, prevent and solve conflicting situations. The second way is as evolutionary, learning objects, which can adaptively change their representation of the subject space, by creating and deleting links and changing weights. A next step in the system's agents design will be focused on adaptive problem, quiz and test generation. In short, this design is made necessary by the fact that a student, after failing to pass a test, has to be presented, after some more learning is done, with a new test, of similar difficulty and contents. As it is difficult for the teachers to generate as many tests as would be necessary for such repeated situations, this task is to be passed to the system's agents. A very important task of each of the agents is also to keep the consistency of the subject link database. The agents inform the teacher(s) if some subjects form loops (determined by the priority connections set by the teacher(s)), if some subjects become inaccessible; if a teacher is not available, they make corrections by themselves, and decide from the student (s) feedback about the appropriateness of those changes.

6 Conclusions

We have proposed in this paper an Evolutionary, Web-based, Academic English Teaching Environment, called "MyEnglishTeacher". Moreover, we have described the rationale, the design and implementation and the modules of our system: an authoring environment for the teacher user(s), which is generating the lessons, and a learning environment for the student user(s). We have further on presented each of these modules in more details. The learning environment is based on two intelligent agents, interacting with each other and the student user, in order to guide the student through a new course for academic English, which is under development in our laboratory. We have also explained in which sense our agents evolve and present intelligence. Our agents build and modify student models with the help of a double graph: a non-weighted, directional priority graph, and a weighted, non-directional, relatedness graph. In addition, we have explained how, from the authoring system courseware design requirements, we enforce the generation of structured content databases, to serve as a basis to the rule/knowledge bases, which will be used and added to by the two agents. We believe that with our system we are addressing more than one current need: the need of an English tutor for academics, which should also be easily accessible – i.e., on-line –, free, adaptive and user-friendly.

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Online ESL Learning: An Authentic Contact

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As communication via telecommunications become easier, learning through online technologies is made possible. In a telecommunications project among US preservice teachers and Taiwanese English as a Second Language learners, Taiwanese students practiced English language and discussed cultural information with US partners who served as online tutors. Data revealed that Taiwanese ESL learners perceived online learning of English language and American culture to be valuable for its authenticity. Instructions on intercultural communication skills were found to be necessary prior to the connection in order to help eliminate misunderstandings between participants of two countries. The success of online learning depended on several factors such as participants' motivation, participants' attitudes, technology, preparation, and support services. Furthermore, Taiwanese learners who had successful experiences applied ten strategies to their ESL learning. These strategies were employed during a circular process of online learning.

Keywords: **ESL, Online Learning, Telecommunications, Intercultural Computer-Mediated Communications**

1 Introduction

The purpose of this research was to investigate a telecommunications project for Taiwanese students to learn the English language and acquire cultural information through online technologies. Preservice teachers (PSTs) at a state university in the United States worked with Taiwanese learners of English as a Second Language (ESL) at a Taiwanese university. The goal of the research was to study intercultural online learning.

In Taiwan, many scholars have been discussing the need for educational reform and change of instructional methods [7][36]. One change under consideration is increased use of online instruction. Taiwanese researchers suggested that the educational reform should include the adoption of methods proposed in the West (i.e., the United States, Great Britain, Australia, and other English-speaking countries), such as involving students in active learning, teaching critical thinking skills, and incorporating individualized instruction [4][25]. Harasim (1990) and Owston (1997) believed that instruction could be enhanced by online teaching. They have stated that online instruction allows for active learning, idea generating, idea linking, and idea structuring as well as helps the students to develop skills in critical thinking and problem solving. Individualized instruction is supported because both synchronous and asynchronous modes of instruction are workable through technologies.

When online teaching is used as a language instructional method, it remedies Taiwan's geographical isolation as an island and provides opportunities for ESL learners to communicate in an authentic English environment. Successful second language (L2) learning includes not only knowing the linguistic features of the language but also understanding the cultural concepts [14]. Sayers and Brown (1987) remarked, "foreign language students

need authentic contacts with native speakers and much practice in a range of language skills -- including reading and writing -- if they are to develop cultural awareness and communicative competence" (p. 23). L2 learners learn language and culture if instruction is facilitated by supportive individualized learning activities [13]. These activities must address the learner's current language level (Krashen's stage of i) and the level beyond the present language and literacy capacities (Krashen's stage of i + 1) [21]. Telecommunications can help overcome the limitations of Taiwanese isolation by providing for supportive and authentic language instruction.

2 Literature Review

Learning through telecommunications has evolved during the 1990s in the West and has proved to be successful [1][8]. To bring more applications into Taiwan, we need to first explore Taiwanese students' needs and attitudes in the use of such technology. Some scholars stated that Asian students employ different learning strategies than students in the West [17][32]. Cheng (1980) pointed out that the educational system in Taiwan has adopted many different educational methods developed in the West; however, utilization has been non-systematic and inappropriate for societal needs in Taiwan. Furthermore, Stewart (1985) and Dooley (1995) noted that the applications of educational technology in other countries besides the United States may be unsuitable because of cultural non-transferability. For instance, other cultures may value a different set of learning and teaching modes when compared to the United States, or they may have insufficient equipment for advanced technological applications. Taiwanese scholars have also urged that future investigations must be done specifically on distance-learning courses in Taiwan [6][37]. Therefore, close examination must be carried out prior to fully adopting new telecommunication technologies as learning tools in Taiwan.

As technology advances, communication over a distance and across cultures becomes easier and inevitable. However, very little can be found in the literature that addresses issues of online intercultural communication and the design considerations that would enhance such interaction. Lee (1999) urged designers and instructors of computer-based instruction to take cultural issues into consideration when developing learning environments and technology integration within curricula. Caution must be taken, especially when intercultural contacts occur in an online learning context, because communicators may not be who they seem to be online [28].

Collis and Remmers (1997) pointed out that to allow successful online cross-cultural contact, at least four issues have to be taken into consideration: communication and interaction, language, content, and representation form. First, communication and interaction are easily misinterpreted across cultures. According to the two researchers, more communication and interaction are not necessarily better than less, and well-structured communication may be preferable for wider audiences. Second, because language includes verbal and nonverbal cultural communication, those developing cross-cultural online instruction must be sensitive to cultural differences in communication styles. Third, designers must choose cross-cultural course content. Last, visuals can overcome problems associated with text-based language. However, one must be sensitive to cultural differences in the acceptability and interpretability of various aspects of visualization.

Research on online connections has been conducted in many areas during this decade. Projects connecting students with teachers or other students in multiple locations were implemented in many subject areas such as science [22], history [3], teaching [27], and language arts [35]. Similar projects in the area of foreign language learning are found in the teaching of Portuguese [20], Russian [30], Spanish [24], and ESL [19][33]. The results of these studies mainly stated how the participants at different sites benefited from the connection in increased technical competence, personal development, language improvement, and more meaningful cultural exchanges. No research has been found that explores the learning strategies used by students while learning a L2 online and the issues encountered during their online intercultural communications.

3 Purposes and Research Questions

There were three purposes of this study: first, understanding the Taiwanese ESL learners' perceptions of learning through distance technologies; second, exploring issues related to online intercultural communication; and third, identifying the learning strategies the Taiwanese learners employed during distance learning to accomplish the

acquisition of ESL and understanding of American culture. The three research questions guided the study were:

(1) How do ESL learners in Taiwan perceive language acquisition and cultural understanding via distance learning technologies after the experience?
(2) What intercultural phenomena can be observed in online learning for Taiwanese students?
(3) What online learning strategies do the Taiwanese use while learning the English language and learning about American culture?

4 Method

This study employed a qualitative research design. This design enabled the researcher to inquire, comprehend, and describe the experiencing world of the participants and the meaning of these experiences [2][26].

4.1 Participants

The project involved students in two different countries: US and Taiwan. There were 40 PSTs in the United States who took either *EDTC 305: Instructional Technology: Theory and Practice* or *INST 462: Language Acquisition and Development* at a state university. These were PSTs being prepared to teach English, ESL, political science, and history at the elementary or secondary level. The same number of participants in Taiwan were students who study in the Department of English Language and Literature at a university in Taipei, Taiwan. They were members of *English Composition and Conversation* classes at either sophomore or junior levels. The US and Taiwanese students participated in this research because their instructors included this online connection project as part of their course requirement. The participants in the United States ranged from the ages of 20 to 22, while the students in Taiwan ranged from the ages of 19 to 20.

In addition, the three professors in Taiwan whose students were project participants were also involved as research subjects. They were interviewed by the researcher in regard to their students' perceptions of online experiences, students' improvement in the English language as well as other types of knowledge through the connection.

4.2 Procedures

To carry out the study, US PSTs corresponded with Taiwanese university-level ESL learners for ten weeks. These PSTs served as tutors of the English language and American culture. The participants in both countries were matched one-on-one randomly prior to the connection. They were also given instructions and orientations on the utilization of e-mail systems and on online learning/teaching. The PSTs were provided with a lecture, discussion, supportive readings, example tutorial correspondences, and a web site of resources. The web site included a downloadable lecture about online learning, the expected online correspondence process guidelines, a midterm survey, sample correspondence, and previous participants' reflections (http://www.coe.tamu.edu/~lcifuent/classes/edtc305/online.htm). They also read on topics such as effective facilitation of computer conferencing [9], computer-mediated communication [18], interactivity in online environments [15], online teaching strategies [8], and cultural differences in teaching and learning [17].

Similarly, the students in Taiwan were supplied with an orientation where the project is introduced to them along with rules and regulations. Sample correspondence, results of previous connections, and suggestions for online learning and discussion topics were presented at their departmental website (http://www.eng.fju.edu.tw/cultural_connections.htm).

Every participant received a welcome letter to encourage them to open themselves up to this new experience. The PSTs were given a rubric with expected number grades to help them accomplish the requirements for their part of the connection. The Taiwanese students initiated the connection by sending out their first e-mail message to their US partners. The US PSTs analyzed their student's language level and started to instruct him or her according to that level through e-mail.

Mid-way during the ten-week connection, the PSTs were asked to fill out an online midterm survey. In Taiwan, the students submitted a brief report to their instructors every two weeks to keep track of their connection progresses.

At the end of the connection, the PSTs and their Taiwanese students filled out a post-connection survey. The PSTs also handed in all of their e-mail printouts and personal journals that reflected their online teaching and learning experiences. Similarly, the Taiwanese students handed in their final reports to their Taiwanese instructors. Two weeks after the end of the connection, the researcher traveled to Taiwan to conduct interviews with 12 Taiwanese students and the three Taiwanese professors. The interviews included open-ended questions.

4.3 Data Collection and Analysis

There were eight data sources: (a) printouts of correspondence; (b) the PSTs' midterm survey; (c) the PSTs' post-connection survey; (d) the Taiwanese students' post-connection survey; (e) the PSTs' reflective journal entries; (f) the Taiwanese students' final reports; (g) transcripts of the interview with the Taiwanese students; and (h) transcripts of the interview with the Taiwanese professors.

Data analysis in qualitative studies is an ongoing process during the research; it is best done simultaneously with the data collection [26]. Each time data are gathered, information was analyzed using procedures proposed by Emerson, Fretz, and Shaw (1995). The steps included close reading, open coding, writing memos, noting themes and patterns, and focused coding.

5 Results

Data analyses revealed remarkable information on the areas of (a) learner perception, (b) intercultural communication, (c) factors affecting online connection, (d) online learning strategies, and (e) online learning processes. First, this particular group of Taiwanese ESL learners was positive about L2 and cultural learning in an online setting. The results of a post-connection survey showed that participants more or less agreed that (a) E-mail connections have a positive place in ESL classrooms (mean of 3.71); (b) the Web-connection has a positive place in ESL classrooms (mean of 3.51); (c) they would participate in another online connection if given the opportunity (mean of 3.58); and (d) they would suggest their other friends or classmates participate in a similar project (mean of 3.85) (see Table 1). Even though the response to the question "Overall, my connection was successful" was not very high (mean of 3.26), learners who had an unsuccessful connection held positive attitudes toward the project. One student wrote in her final report, "My pal does not respond to me so often. I didn't learn much through this project this semester. But that doesn't mean this project is not good. I hope school brothers or sisters can still have the chance to get in this project."

Table 1. Taiwanese Students' Responses Toward the Online Connection

Questions	M	SD
The **E-mail connection** has a positive place in ESL classrooms.	3.71	0.67
The **Web-board connection** has a positive place in ESL classrooms.	3.51	1.50
I would participate in another online connection if given the opportunity.	3.58	1.13
I would suggest other friends or classmate participate in a similar project.	3.85	0.78
Overall, my connection was successful.	3.26	1.07

Note. Participants responded on a 5-point Likert scale (1= Strongly Disagree; 5 = Strongly Agree). The survey was complete by 37 participants.

Second, intercultural communication issues cannot be ignored. A lot of Taiwanese learners interpreted that their tutors were angry with them when they did not receive messages over a week. In addition, learners read what wasn't intended in the messages. They constantly apologized to the PSTs for being an inconvenience. Several learners ceased active interaction with the PSTs due to these personal interpretations. The Taiwanese professors suggested that acquainting learners with different thinking patterns and expression styles is necessary in future connections.

Third, factors that affected online connections included participants' motivation, attitudes toward each other, participants' fields of experience, frequency and quality of interactions, technology, preparation, and support

services (figure 1). Any missing component would hinder the success of the connection. Other resources such as teachers, peers, family members, libraries, and web resources provided extra assistance to the participants.
Fourth, during the correspondences, ten learning strategies were found to be used by the learners in their messages. These were paraphrasing, translation, Q&A from tutor to student, Q&A from student to tutor, explanation, elaboration, decision-making, self-reflection, metacognition, and transfer. The learners in the more successful pairs tended to use a variety of the ten strategies.

Finally, data indicated these ESL learners went through a series of processes for successful learning (figure 2). Motivated learners set learning goals for themselves with the PSTs' help. Those who prepared themselves well by finding topics of discussion or information in the libraries, the WWW, and traditional learning environment aimed for frequent and quality interactions via e-mail with the PSTs. After each interaction, a review period prompted learners for more interactions. Learners who went through these stages concluded that they had learnt new information and increased their confidence in using English reading and writing skills. Needless to say, this result increased their motivation to learn and thus encouraged the start of another learning cycle.

6 Discussions and Conclusion

This study is significant to both distance-learning educators and language-learning educators. There are at least three reasons for this significance. First, the study provides insights for distance educators, both for those in Taiwan and for those in other countries who have Taiwanese students enrolled in courses that are delivered via telecommunications. The results of the study help these instructors to further understand Taiwanese students' positive perceptions of L2 learning through online technologies, identify suitable conditions and environment for these learners, and decide the extent to which this mode of instruction is applicable to students from this cultural background.

Second, the online intercultural communications issues explored in this study assist telecommunications users with more effective communication. They help users become aware of and anticipate problems when coming into contact with people of other cultures via distance technologies. Even without using online technologies, intercultural communication is already complex. Therefore, interaction may be hindered further when technology is the transmission medium. Understanding the barriers and facilitators of online intercultural communication leads to better and more successful intercultural interactions.

Third, the identified ten online learning strategies and online learning processes will add to the literature on language learning and teaching. Such research is in demand because ESL programs in the United States are planning to deliver more ESL courses to foreign countries via distance learning technologies.

In summary, most Taiwanese ESL learners had a positive experience with the online connection. The few connections that failed were due to lack of participants' response, lack of participants' motivation, and technical failure. Nevertheless, providing L2 instruction to learners over cyberspace is a method that should not be ignored. Learners need to be prepared with adequate intercultural communication skills and online learning strategies.

Follow-up investigation of online ESL acquisition might include specific amount of improvement on learners' writings and learning via synchronous technologies such as chats, interactive videoconferences, and desktop videoconferences.

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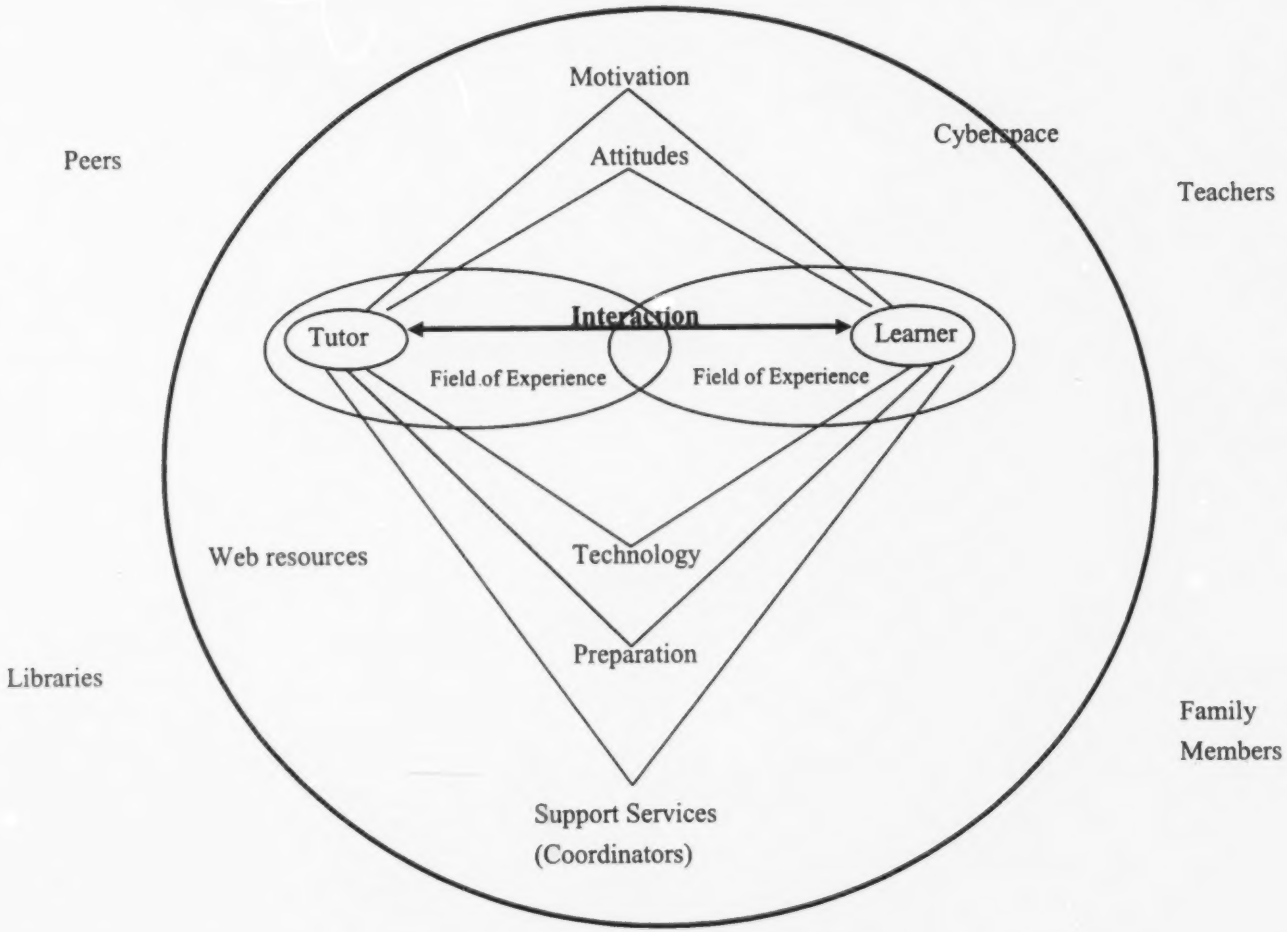

Figure 1. Factors Affecting Online Connections

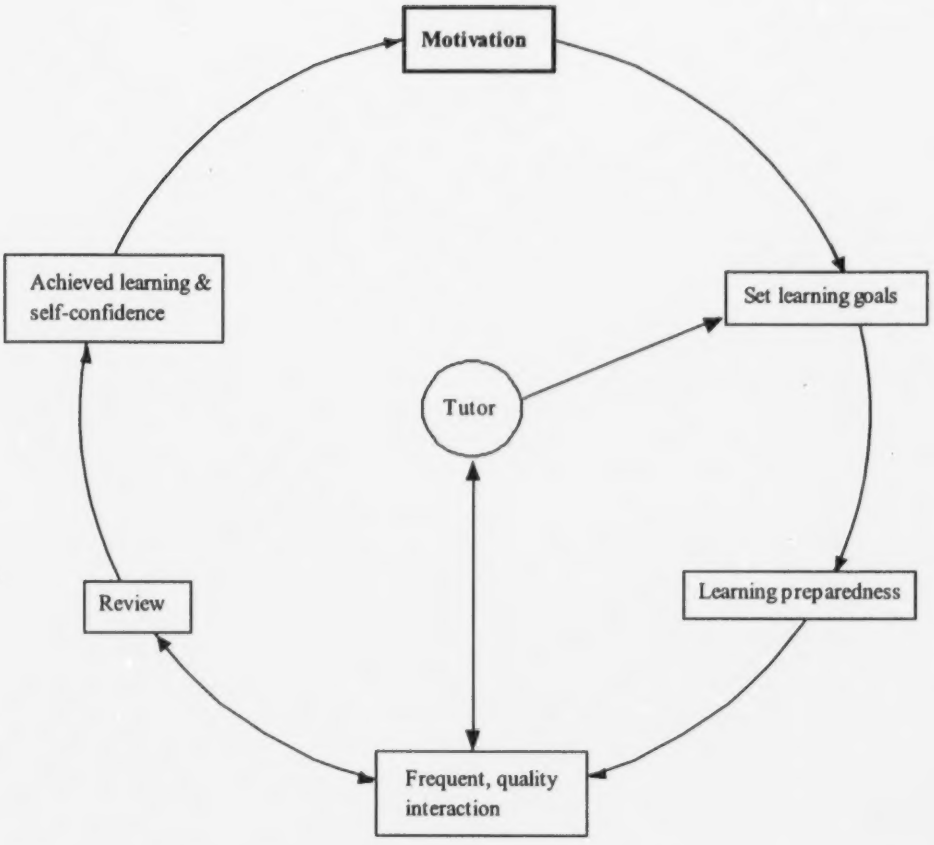

Figure 2. Online Learning Processes in the United States-Taiwan Connection.

Schema Theory-based Instructional Design of Asynchronous Web-based Language Courses

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Instructional design (ID) provides a framework to facilitate both teaching and learning activities. ID also prescribes desirable learning outcomes. This paper introduces the implementation of an ID template in web-based language courses. The ID template incorporates several cognitive strategies based on schema theory. A schema-theory-based model provides a useful framework for knowledge organization and information processing. In a course that emphasizes reading comprehension, schema theory accounts for how learners construct meaning from texts based on the information they encounter, the prior knowledge they already have, and the way they interact with the new information. The ID template consists of four instructional sequences. The cognitive strategies, ID examples, and purposes for each sequence are illustrated. The sequences include warm-up activities, preparatory activities, core activities, and post activities. Each sequence is interconnected with the others and looped back to the beginning in each lesson unit. The preliminary evaluation results indicate the degree of student satisfaction for the ID template for various external and internal factors.

Keywords: **instructional design, schema theory, cognitive strategies, web-based foreign language instruction**

1 Introduction

Instructional design (ID) plays a critical role in the success of distance education. ID is an interdisciplinary science that provides a theoretical background for the design and implementation of instructional units to achieve desirable learning outcomes. ID principles encompass theories in both learning and instruction. Although the instructional design for web-based instruction does share some common principles with instructional design for traditional classroom teaching, the modes of instruction and learning are quite different from each other. The roles of learners and instructors continue to go through fundamental changes as well. What kind of instructional theories can be best applied to web-based education? There is no one single universal theory for all instructional design as the objectives, learning contexts, subject matters, and expected learning outcomes vary from one field to another. The development of ID also depends on the pedagogical principles that the instructors or instructional designers adapt to. The views on instructional design can be approached from different perspectives such as behavioral (Gropper, 1983); systematic (Gagne, Briggs, & Wager, 1992); structural (Scandura, 1983); motivational (Keller, 1983), transactional (Merrill, 1997); and cognitive (Tennyson, 1990; West et al., 1991). Cognitive schema theory especially receives prominent attention in the field of instructional design and language education for its emphasis on the use of aid for perception, learning, comprehension, and recall (Anderson, 1984; West et al., 1991). This paper focuses on the application of schema theory to the instructional design of language courses delivered through the World Wide Web. The preliminary evaluation results are summarized at the end.

2 Theoretical Framework

Why is ID important in web-based distance education? Reigeluth (1983) argued that ID is a linking science between theory and practice. This linking science was further elaborated by Tennyson and Schott (1997): "As a field of study, it provides a theoretical foundation to principles of instructional design, a research base confirming the theoretical foundations, and a direct involvement in the application of those principles" (p. 1). ID theories prescribe the variables and conditions required for certain learning outcomes. Furthermore, the practice of ID utilizes various methods and technologies to develop learning environments based on these theories (Tennyson & Schott, 1997). Many ID models have been developed and the theoretical bases vary greatly. A typical model includes the following five steps: "(1) setting the *objectives;* (2) *preassessment*, that is, determining whether the target students have the prerequisites to benefit from the instruction; (3*) planning the instruction*; (4) *trial*, that is, presenting the instruction for developmental purposes; and (5) *testing* and *evaluation*" (West et al., 1991). Each step can be further divided into more detailed instructional sequences. The focus of this paper is on planning the instruction based on cognitive learning theories. Schema theory is an especially appropriate cognitive learning theory because of its emphasis on knowledge organization and representation.

There is no one single theory called schema theory. It has evolved and become the basic component of many cognitive learning theories. According to cognitive theorists, schemas or schemata are mental data structures that represent our knowledge about objects, situations, events, self, sequences of actions and natural categories (Anderson, 1985; Rumelhart, 1981). Schemata are also like scripts of plays (Schank & Abelson, 1977). In other words, schemata are chunks of knowledge stored in the human mind by patterns, structures, and scaffolds (West et al., 1991). Based on Rumelhart's definition (1981), schemata serve the function of "scaffolding." Knowledge is perceived, encoded, stored, and retrieved according to the chunk of information stored in the memory. Schemata facilitate information processing. Schema can be "instantiated" by specific examples of concepts or events. For example, one's schema for "teaching" can be instantiated by viewing a scenario on the interaction between a teacher and students. As soon as schemata are instantiated, one can associate or recall more similar scenarios (Bruning et al, 1995). Schema theory is appropriate for language instruction due to its powerful explanation of memory and recall. In the case of reading comprehension, schema theory accounts how learners construct meaning from texts based on the information they encounter, the prior knowledge they already hold, and the way they interact with the new information (Bruning et al, 1995, p. 275). As summarized by Andre (1987), schemata serve the following important function in reading comprehension:

1. Providing the knowledge base for assimilating new text information
2. Guiding the ways readers allocate their attention to different parts of reading passages
3. Allowing readers to make inferences about text materials
4. Facilitating organized searches of memory
5. Enhancing editing and summarizing content
6. Permitting the reconstruction of content (Bruning et al., 1995, p. 275).

Schemata provide the backgrounds for learners to comprehend a text by inference. Schemata also make it possible to summarize a passage by selecting the parts that are important to them. These processes cannot be completed without the knowledge structures that schemata provide. Since one of the elements of schema theory is making predictions based on what learners already know, making the link between the old information and the new information has generated a great deal of research interest. Two areas of research in this direction are advance organizer and schema activation.

Advance organizers employ the structure of some materials that the learners are already familiar with as the framework of the new materials. In other words, advance organizers are designed to offer "ideational scaffolding for the stable incorporation and retention of the more detailed and differentiated material that follows" (Ausubel, 1968, p. 148). Advance organizers are relevant introductory materials that are introduced in advance of the core texts. Recent studies have also shown that providing short and concrete examples for upcoming events are more useful to readers than abstract, general, and vague learner organizers (Corkill et al., 1988).

Schema activation refers to the design of activities for the purposes of activating learner's knowledge in

similar fields prior to learning new subject matters (Bruning et al., 1995). They are often in the forms of short questions. In a way, schema activation serves similar purposes of advanced organizers by linking new information with old information that the learners already know. However, schema activation relies more on the learners to generate information from their previous knowledge base. Schema activation works better if the schema activating activities are relevant to the to-be-learned information. A study on the reading comprehension of a group of fifth-graders showed that the group with relevant schema activation remembered the reading texts better than the groups with non-relevant schema activation (Peeck et al., 1982).

There are also many other cognitive strategies that help students with reading comprehension. These strategies are designed to help students in gaining control of their learning process for the purpose of comprehending reading texts. Bruning et al. (1995) summarized the following five strategies for reading comprehension:

1. *Determining importance:* Instructional activities can be designed to help learners locating the main ideas of the text. Without knowing the main ideas, readers would have a hard time understanding the text.
2. *Summarizing information:* Students should not only learn to summarize the main ideas in a passage but also generate a text that represents the original one. Students' reading skills improve when their summarization skills improve.
3. *Drawing inferences:* Studies have shown that the ability to make inferences is positively associate with reading skills (Dewitz et al., 1987; Raphael & McKinney, 1983). Good readers are usually good at guesswork.
4. *Generating questions:* Good readers ask questions frequently. Through self-questioning or peer-exchanged questions, learners will have a better understanding of texts.
5. *Monitoring comprehension:* Readers should have the ability of knowing when they understand the text and when they do not. A good reader also has the ability to detect errors and inconsistencies in the reading materials. When they become critical of the reading texts, they do a better job in detecting errors. Peer editing or peer-critiquing is a good way to monitor comprehension (Bruning et. al., 1995, p. 279-284).

The next section describes how some of the cognitive strategies can be employed in the instructional design of web-based language courses.

3 Instructional Design Template for Web-based Language Courses

The web course introduced in this paper is the first one in a series of Asian language courses using the same instructional design templates. There is a lack of higher-level language courses (3rd year and above) in Less Commonly Taught Languages (LCTLs) such as Asian languages and other non-Roman languages in American universities and colleges. Yet, the need for higher-level language courses does exist for students who would like to continue language studies. The objectives of the web courses are to provide opportunities for students whose institutes do not provide language courses in LCTLs and to disseminate information on the ID model of pedagogically sound language instruction. The first course that is currently offered through the University of Hawaii systems is a Chinese reading and writing course at the 3rd and 4th year level. A Chinese listening/reading/writing course and a Korean reading/writing course will be offered in fall 2000. More courses in Japanese and other LCTLs are in the planning stage at present. The instructional design template is summarized as follow:

Goal: To improve Chinese reading and writing skills.

Objectives:

1. Students will possess the skills to decipher reading materials through a series of cognitive strategies.
2. Students will improve writing skills through continuous revisions, peer-critique, and teacher feedback.
3. Students will have a good command of vocabulary in the subject matters covered in the course.
4. Students will co-construct knowledge together through collaborative tasks in building word bank, grammar clinic, and essay database.

Content: The content covers a wide variety of topics based on authentic teaching materials collected from China and Taiwan, including topics such as cuisine, travel, medicine, celebrities, university, and so on. These materials were developed into ten self-directed reading lessons on a CD-ROM. The web course uses the CD-ROM as the core reading materials. Each web lesson unit was designed to enhance the understanding of the equivalent core text in the CD-ROM.

Format of the Instruction: The World Wide Web and the CD-ROM were selected to deliver the instruction and course content. Asynchronous communication via email and web-forum are the means for student-student and student-teacher interactions.

Table 1 Instruction design template for web-based language courses

ID Sequence & Modules	Cognitive Strategies	ID Examples	Purposes
1. Warm-up activities	Schema activation	Word bank	Brainstorming on terminology Co-construction of knowledge base
2. Preparatory activities	Advance organizer	Picture matching	Preparation for forthcoming texts
3.1 Core activities	Determining importance Drawing inferences	Working on CD-ROM reading activities	Determining the importance of information
3.2 Core activities	Generating questions	Q&A	Self-questioning
3.3 Core activities	Scaffolding	Small Group Discussions	Debate/Discussion/Role Play Use input for other activities
3.4 Core activities	Monitoring comprehension	Grammar Clinic	Peer editing with teacher feedback
4.1 Post activities	Modeling	Sample essay	Teacher demonstration
4.2 Post activities	Recall	Language work	Monitoring comprehension
4.3 Post activities	Summarizing information	Composition & revision	Individual output with collective database on writing samples

Sequence of Instruction: The framework of the instruction sequence is adapted from Hiple and Fleming's (1996) work which is specifically designed for foreign language instruction. The ID examples are developed by the instructors Fleming & Lu (1999) for web-based language courses. There are eight units in each web course. Each unit employs the following four sequences of instruction.

1. *Warm-up activities:* These activities employ simple and short questions to activate learners' previous knowledge relevant to the subject matter. For example, on the unit for cuisine, students are asked to write down two or three things they know about Chinese cooking. Their responses are put into a database called the "word bank." By the end of each unit, students have accumulated an abundant collection of glossary under a specific language topic.
2. *Preparatory activities*: Students are asked to match some descriptions with pictures. These pictures provide a background information of the lesson and prepare the students for the forthcoming texts.
3. *Core Activities*: There are four components in Core Activities: working on the CD-ROM, Q & A forum, Small Group Discussions, and Grammar Clinic. Students first go through the reading activities in the CD-ROM. They then post questions about the content of the CD-ROM on the Q & A web forum. Following that, they are divided into three-member or two-member small groups to carry out a conversational task. Take the cuisine unit for example, they have to make up their minds on which restaurant to go to for dinner. One conversation example is provided so that students know in advance the scope and depth of the expected conversation. In Grammar Clinic, the instructors pick several erroneous sentences from the Small Group Discussions and post them

at the Grammar Clinic (a web forum) for peer editing and critiquing. All these sentences are posted anonymously.

4. *Post Activities*: In the final stage the learners model from teacher's examples and peers' writings before they work on their own essays independently. First, the teacher provides a sample essay and a language matching exercise to reinforce the key words in the essay. Gradually, teachers withdraw help and let the student compose their own essays. If they have a hard time starting, they can view other students' submissions of essays in the database to come up with more ideas.

Among the eight units, the last two units are designed for language exchange with native speakers from the country of the target language. For more details, please refer to the web site (http://www.lll.hawaii.edu/yuedu). The ID template can be modified for different language instruction. The Word Wide Web is an especially perfect media since all information is recorded and saved in the database. Students can always go back to review the collective database for their own review.

4 Evaluation of the web course

In the evaluation process, the instructional design team is interested in student feedback on the sequences of instruction. At the end of each unit, students are asked to fill out an anonymous feedback form that consists of 10 questions on a five-point Likert scale. Comment areas are provided for each question. Table 2 shows the preliminary partial results on the ID template evaluation.

Students had provided valuable feedback to the instructional design team. The team was able to use this feedback to adjust course content and activity design. Generally speaking, students agreed that most instructional design modules are useful for their learning. The degree of helpfulness varies from module to module. However, it seems that the students generally did not like the use of the CD-ROM. One reason is that the CD-ROM could only be used on a Macintosh while 95% of the students in the class used PC-compatible computers. PC users were restricted to use campus Macintosh computers to access the content in the CD-ROM. Furthermore, since the CD-ROM was developed for self-directed learning, there was also a lack of interaction between students and teachers. Finally, there were some bugs in the programming of the CD-ROM. Students were not enthusiastic about the programming bugs. The team is in the process of converting the CD-ROM into cross-platform media and fixing the bugs.

Table 2 Feedback on Instructional Design Lesson Template

1 = Strongly disagree; 2 = Disagree; 3 = Slightly Agree; 4 = Agree; and 5 = Strongly Agree		Unit 2 (mean)	Unit 4 (mean)	Unit5 (mean)	Unit7 (mean)
	Post Unit feedback questions	(n=11)	(n=9)	(n=11)	(n=9)
Q1	I have gained new knowledge from this unit.	4.09	3.78	3.73	3.56
Q2	When I ask for help, the instructors respond in a timely way.	4.45	4.33	4.09	3.33
Q3	When I ask questions, the instructors give me the answers I need.	4.36	4.33	4.09	3.67
Q4	The warm-up activities are useful. (i.e. contributing and sharing vocabulary)	3.73	3.78	3.73	3.44
Q5	The preparatory activities are useful. (i.e. matching pictures to text)	3.91	3.67	3.36	3.22
Q6	The content of the core lessons (CD-ROM) is well designed.	3.18	3.33	2.91	NA*
Q7	The forum discussions (i.e. Q&A, role-play, small group discussion) are useful.	4.09	3.78	3.73	3.33
Q8	The grammar clinic is helpful.	3.45	3.89	3.73	NA*
Q9	The language work is at the proper level of difficulty.	4	4.00	3.55	3.56
Q10	The essay writing is at the proper level of difficulty.	4.09	4.22	4.09	3.67
	Average	3.94	3.91	3.701	3.473

* Unit 7 is designed for language exchange. The questions on CD-ROM and Grammar Clinic are not applicable.

As for the web-based instructional modules, the warm-up activities were not deemed as useful as the instructional design team had expected them to be. When monitoring student online activities through the server-tracking program, it was found that most of them did not go back to use the database after submitting

the required entries. The instructor started requiring the students to incorporate the vocabulary into their essays towards the end of the semester. By then, it may have been too late to see how the change in instructional strategy would affect the way the students utilize the database. This is a good lesson for instructional designers. All instructional sequence should be interconnected and continuously looped back to the beginning. If the instructional modules are designed as stand-along units, students will not see the purpose of building on the knowledge based that they have co-constructed.

Finally, there seems to be a slight decline in the helpfulness of the ID modules when comparing the average in table 2. The perceived helpfulness declines especially in unit 7. The change in instructional format (i.e., language exchange) and the more specialized topic (i.e., movies) may have posed a greater challenge for less competent students. Interviews with the student may help to find out the real reasons. Nevertheless, the comments from students were overall positive. Here are a few comments from the students.

" The warm-up activities have been very helpful in preparing for the entire lesson."

"The preparatory activities makes one think harder about the subject material."

"Small group discussion wasn't as interesting as the previous units because there were a little interactions among students."

" I believe I would not have learned all of the new words from a textbook. Contributing and sharing vocabulary for this unit has really helped my ability to read the Chinese newspaper's entertainment section."

"The text for this section was presented in a way that forced me to focus and analyze more fully the meaning. A good challenge which I enjoyed."

" This unit helped me to learn unique vocabulary for discussions with almost any Chinese speaker. I am more confident that I can carry a conversation with a Chinese speaker about my favorite movie."

"While on occasion some vocabulary has been a little bit difficult, once I put the sentence or paragraph into context, the usage of the vocabulary became more clear."

5 Conclusions

ID sets up a framework for desirable learning outcomes. The incorporation of cognitive strategies helps students to efficiently achieve the learning objectives. It can be found from their comments that the students valued greatly the aspects of online interaction and co-construction of a knowledge database. It is through the collaborative tasks that they are able to interact for a purpose, i.e., for the completion of a task that has a real-world application. The overall ID objectives have been met through the instructional sequences. Nevertheless, there is not much evidence supporting the effectiveness of the ID modules other than students' own remarks. Further study on the comparison of the actual online activities (e.g. tracking the mouse clicks) with their perceptions on the usefulness of each ID module can provide more insight into the effectiveness of the instructional design. In addition, an objective panel of language experts to evaluate the performance of the students could also provide assessment to the final learning outcomes.

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The Design of a Synchronous Computer Aided English Writing Environment for the Internet

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The design of a synchronous computer aided English writing environment is described. Two novel mechanisms have been designed to provide the two fundamental capabilities on the Internet: (1) synchronous text co-editing, and (2) voice delivery. The system exploits the integration of computer and networking capabilities with linguistic and pedagogical principles crucial to distance language learning. In addition to the advanced capabilities of the synchronous writing environment, the system archives the learners' English writing production and content of learner-tutor interactions in a searchable database. The resulting archive offers a novel source of information that can radically extend the scope of research into second language acquisition and into the effectiveness of second language teaching. The data can also raise learners' self-awareness concerning their own language learning and provide teachers a window onto the recurrent needs of learners and the effectiveness of various responses to these needs.

Keywords: **Computer aided language learning (CALL), Distance learning, Learner corpus, Voice transmission, Co-editing**

1 Introduction

With the rise of the World Wide Web, there has been a corresponding resurgence in Computer Aided Language Learning (CALL). Currently, there are numerous commercially available packages ranging in format from CD-ROMs to web-based systems. While CD-ROMs are limited in the resources that can be included and in the level of interactivity and responsiveness to individual users, web-based systems have the advantage of transcending these limitations. More specifically, the Internet offers the potential of integrating content with computer and networking capabilities. Despite this potential, however, current web-based CALL systems are often limited to static systems which store content in relatively easily accessible formats. Among the limitations in these approaches, students are either constrained by restrictive sequencing of materials or fixed content; the learning behavior or performance of students is not recorded or exploited for insights into their needs or difficulties; the experience of previous users (whether students or teachers) is given no role in providing feedback or in evaluating the users or the system.

Among the distance learning systems on the Internet, a fundamental distinction can be drawn between two basic modes of interaction available: *asynchronous* and *synchronous*. In systems using the asynchronous mode, lecture content is provided, typically on web pages. Learners may pose their questions or opinions on discussion boards, and e-mail serves as the main communication channel. These systems lack capabilities for real-time communication between instructors and learners or among peers. In environments that use the synchronous mode, on the other hand, systems are required that support real-time communication modules and interactivity. Many currently available systems have text, audio, and video communication capability.

However, these systems do not take the specific needs of language learning and teaching into consideration.

In this paper, we propose a learning environment designed to overcome the above restrictions. Based on the proposed design philosophy, a synchronous English writing environment, WriteNow, has been designed and implemented on the Internet. The work reported here is the result of collaborative research between Computer and Networks (CAN) and Research in English Acquisition and Pedagogy (REAP) laboratories at Tamkang University.

The proposed system consists of two main components: (1) a synchronous English writing clinic and (2) an archived log of learner and learner-tutor output. In the first component, the synchronous writing clinic, we make use of a web-based user interface and provide the following functions: (1) an online essay display board with synchronous co-editing and dialog capabilities, (2) real-time voice communication, and (3) an online comment bank for tutors where frequently used comments can be easily stored, retrieved, and offered to students during the online tutorial sessions. The WriteNow system, then, differs from conventional CALL software packages in that it offers global access over the Internet, identifies the needs of learners and tutors, and provides online tools designed to meet these needs.

In the following sections, the description of the system is organized as follows. In section 2, an overview of the system is given. We illustrate the design philosophy and building blocks of the system. In Section 3, we describe in detail the technical mechanisms, such as session management, the co-editing mechanism, and voice transmission. The system implementation and user interface are described in Section 4. Directions for future work and a conclusion are given in Section 5.

2 System Overview

2.1 The Overall Online Language Learning Environment

WriteNow is one module in a larger web-based English learning environment designed to give learners and teachers access to each other and to online learning resources [11]. The larger system combines several components currently at various stages of development into an integrated online language learning environment weaving together the study and practice of English writing, reading, listening, and speaking skills. The environment has been designed based upon some basic premises concerning the domain of second language learning and teaching. First, language skills are best learned in a mutually reinforcing integrated environment that offers generous access to authentic English input as well as immediate feedback. Second, students learn best not simply by studying English but by using it in meaningful contexts as well. Finally, while the dearth of such idealistic conditions for English learning in non-English speaking settings is one of the most serious obstacles to EFL learners in those contexts, thoughtfully designed web-based systems can provide EFL learners with global access to these conditions. Crucially, however, such systems must be designed according to specifications provided by linguists and experienced language teachers.

The design schema of the overall system is represented in Fig. 1. Two sorts of language data are fundamental to this environment: English input offered to the learner and English output produced by the learner. With respect to input to the learner, the system's architecture enables content to be retrieved from a variety of sources in a range of media (text as well as multi-media). These can be edited or annotated for the learner by teachers or materials developers and then made available to the targeted learners. Learners access this English input through the learning environment at the center of the system. Here the learner's interface provides interactive access to content and to teachers and tutors. As far as output is concerned, learners are able to write essays and participate in online discussion boards with the help of online dictionaries and writing supports. Teachers, in turn, are provided interfaces through which they can comment on the learners' production. Crucially, these interactions are stored as annotated learner data, and learners, teachers, and researchers can access and analyze the relevant performance data and feedback. Researchers have authoring tools to create online help that addresses precisely the errors that they uncover in their investigation of the learner output. In this manner, the expertise of instructors and researchers and the learning experience of learners can be accumulated and shared with all users.

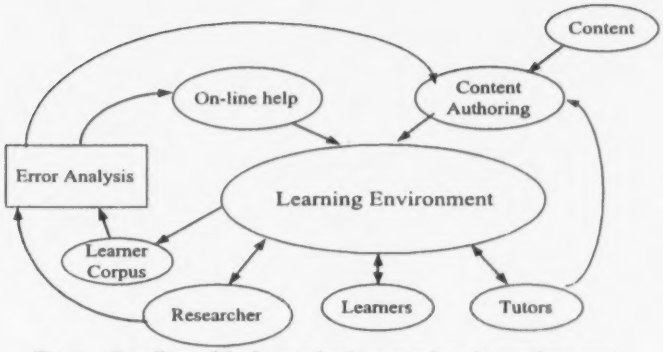

Fig. 1. Paradigm of the interactive language learning environment

2.2 The Synchronous Online Tutoring Environment

To simulate an on-site writing clinic on the Internet and to exploit the potential of the integration of computers, communication networks, linguistics, and language pedagogy, the proposed writing environment is equipped with the following special tools and functions.

(1) Co-editing: The essay under discussion is pasted by the learner onto the essay display frame and is displayed simultaneously on the tutor's and learner's computer screen. By using the mouse to select any portion of the displayed text, both learner and tutor are able to work on the same sentence and immediately identify the writing problem. Co-editing the same sentence, however, may result in conflicting data if a suitable co-editing mechanism is not available [1][4]. To satisfy this requirement, a textual co-editing mechanism has been developed.

(2) Online conversation: To enhance communication between the participants within this environment, a real-time voice conversation channel has been provided. Since most of the present Internet environments deliver only best effort service, we have developed a voice transmission scheme to overcome packet delay [6][7], jitter [12], and packet loss [10][8] in order to provide improved quality voice transmission for our purposes.

(3) Comment bank: The design of this environment provides users with the ability to mark a specific portion of an essay and immediately give comments concerning that portion of text. Giving comments is the basic tool that tutors have for conveying their specific suggestions to students about a piece of student writing. To reduce the tedious and repetitive aspects involved in giving this feedback, the tutors' interface includes a bank of easily retrieved frequently used comments. A standard set is provided, and, in addition, each tutor can edit these comments or create her own. The standard set consists of positive comments as well as corrective ones and simple but important session management comments (for example, 'has your teacher already given you any suggestions about this essay?' or 'Please paste your essay in the frame now.') As is well known, instructors' comments contain invaluable information for the learner. Fortunately, since the channels of communication for the WriteNow system are computer and networks, this data can be recorded, archived, and indexed to the specific portion of student text that each was aimed at. The data is retreivable by learners, teachers, and researchers, providing rare insights into the learners difficulties and the learning and teaching process.

(4) Online help: The WriteNow interface offers learners and teachers online access to learner dictionaries and other language resources that can be conveniently consulted during the tutorial session. This design feature is intended to meet the goal of providing students input and feedback at the moment of need. In addition, the overall online environment provides an authoring environment where domain administrators can create online help targeted specifically to the problems uncovered in research on the learners' English output. In the future, these helps will be made available in the WriteNow synchronous environment as well.

(5) Comment tabulations: A means of reflecting on the nature of students' writing difficulties and on the sorts of communication that tutors find useful in discussing the essays with students is provided in the

form of statistics on comments that have been used. A record is kept in each session of how frequently a comment has been given.

3 Design of Synchronous English Writing Clinic

Design of synchronous English writing clinic, WriteNow, is presented in this section. In the WriteNow module, we focus on designing the functions that provide real-time communication capability and *interactivity*. We describe the design of the system's special features: (1) the textual co-editing environment, (2) voice transmission on the Internet, and (3) the comment bank design.

3.1 Textual co-editing environment

The basic purpose of the co-editing environment is to allow two users who are separated by distance (for example a student and a tutor or two students) to discuss a piece of student writing and specifically to enable both parties to focus on the same portion of text at the same time and communicate clearly about that portion of text. In other words, the environment is intended to allow synchronous tutorial sessions for writing instruction.

This co-editing environment includes two modes, *control* mode and *free* mode. In the control mode, a priority scheme is set in place so that the tutor can overwrite the learner's output. In the free mode, the environment allows a two-way override in order to give the users a higher degree of flexibility in modifying the essay. In the free mode, however, data conflict can occur. With conventional, floor control mechanisms, such as token control, the data conflict problem is resolved at the cost of some degree of flexibility [3][5]. In the proposed approach, a co-editing mechanism, *Temporal And Spatial Data conflict detection* (TASD) [1], is developed which takes data consistency and user flexibility into account. The designed algorithm resolves the data conflict by using an *undo* process. Intuitively, data conflict arises when two events occur within the same markup area. By further analysis of the events into relationships such as temporal relations, spatial relations, and event attributes make it possible to avoid many *undo* processes. The version of the co-editing algorithm proposed here is an extension of our previous work [1].

3.2 Voice transmission on the Internet

As is well known, currently the Internet offers only a point-to-point *best-effort* service, which may present packet delay, delay variation, and packet loss. As a result, the voice quality is degraded. We have designed a voice tool to overcome this type of transmission difficulty [2][9]. We emphasize the design of redundant packet sending mechanism and QoS monitoring mechanism. The redundant packet sending mechanism evaluates the sending packet from a set of compression packet formats to compensate packet loss. The QoS monitoring mechanism serves the purpose of collecting the present network traffic conditions such as delay, delay jitter, and packet loss. The information is then used in playout time adjustment.

3.3 Comment Bank Design

The design of comment bank serves two purposes: (1) it reduces the tedious work of the tutor and (2) it permits the tabulation of online error statistics. To achieve these purposes, the comment bank has a standard set of comments as shown in Table 1 and an optional set of comments. There are three classes in the standard set of comments, namely, (1) starting comments, which help start the session with initial questions about the assignment, (2) comments about grammar, diction, and mechanics (such as punctuation), and (3) comments about rhetorical elements such as organization and unity. The most frequently used comments are collected in the comment bank so that tutors need not type them each time from scratch but can simply select them from the bank. The standard set of comments is shared among all tutors whereas each tutor has an optional set of comments which she or he can edit or modify according to individual preferences.

Table 1 The standard comments set

Class	Tag	Comment
	Welcome	Welcome online. What can I help you with?
	Draft of your essay	Do you have a draft of your essay to show me?
	Paste essays	Please paste your essays into the frame.

Starting comments	About this assignment	Tell me a little about this assignment.
	Audience	What audience you are to write this for?
	Teacher seen	Has your teacher seen this draft before?
	Teacher said	Tell me what your teacher said.
	What help	What would you like help with?
Comments about grammar and diction	Wrong word	I don't think this expression conveys what you are trying to say here.
	Fragment	This is a sentence fragment.
	Splice	This is a comma splice.
	Run-on	This is a run-on sentence.
	How to fix	What would be a way to fix the problem?
Comments about rhetorical elements	Unclear	I don't understand what this means here.
	Main idea?	I can't see the main idea of this part.
	Relevance	I don't see how this is related to the rest of the essay.
	Unity	It isn't clear how these ideas are related to each other.
	Give an example	You probably need an example to show what you mean.

4 Implementation and Results

The WruteNow system is implemented with MS Visual C++ 6.0. Currently, the system runs on a Windows 98, Windows 2000 or Windows NT platforms and is available for the students in the Department of English at Tamkang University.

The graphic user interface of WriteNow is shown in Fig. 2. After the initiation of the main page, a user can select the tutor from the online user list. When the connection is made between two users, learner and tutor make use of the co-editing area as editing ground. The markup area will also appear on the screen at the remote site, allowing both users to simultaneously focus on the same portion of text though they are at distant locations. The comment bank and online help also appear during a tutoring session—the comment bank for tutors only and online help for both tutor and learner. The content of comment bank is described in section 3.3. Currently, users can access an online electronic dictionary, a corpus of standard English which can be queried for examples of vocabulary in use, and so on. Both learner and tutor may select the corresponding tool from the main page. A voice control panel and text discussion board are provided as well. Thus, users may choose these communication channels for their convenience.

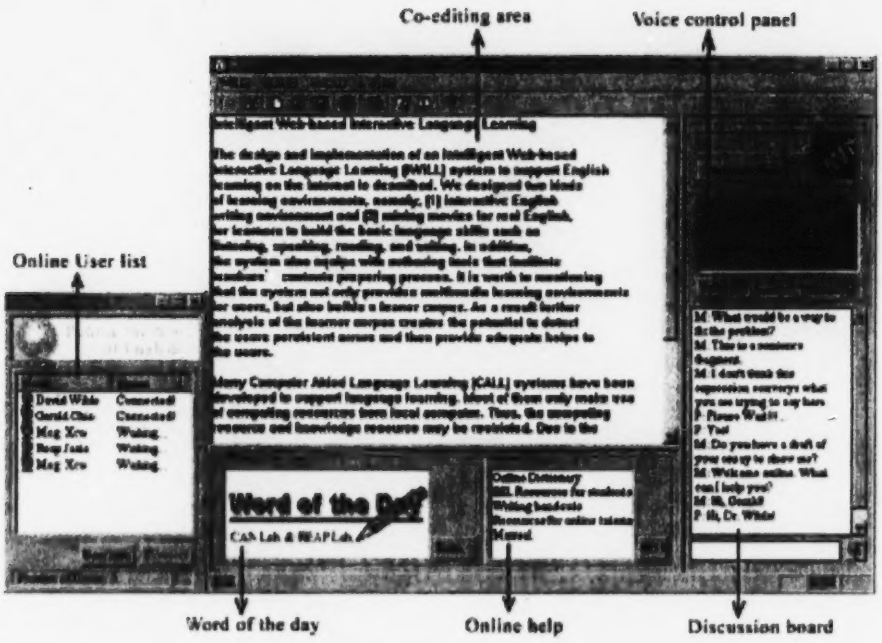

Fig. 2 The WriteNow synchronous virtual writing clinic GUI

5 Conclusions and Future Work

The advance of computer and Internet technology has resulted in dramatic changes in contemporary society. At this stage, one critical challenge brought by these changes is how to use these technologies in the development of novel and effective learning environments. In this paper, we illustrate our design philosophy, premised upon the integration of computer and networking technologies, linguistics, and language pedagogy in the construction of a synchronous virtual writing clinic, *WriteNow*, on the Internet. The proposed system not only breaks down temporal and spatial limitations, but also provides tools for detecting learning difficulties and addressing them in an online environment.

To achieve the design goals, the developed system consists of the following features which are distinct from usual networked writing environments. First, it provides *a co-editing* environment with voice communication support allows the users, to attend to a common focal point though separated by great distances. Thus, users may co-edit the same sentence and then identify relevant learning problems immediately. Second, a comment bank is provided which includes comments for encouragement and reinforcement, for correction, and for practical matters of session management. Through the tutor's use of the designed comment bank, a learner can be made aware of the nature of their problems and strengths and can be offered immediate resources that address these. Moreover, the data collected are recorded in learnerdata archive. Further data analysis can be applied offline to detect persistent learning difficulties. These data build the basis of inter-language research and the creation of online language help aimed specifically at empirically attested learner difficulties.

The developed system is currently being tested in the Department of English at Tamkang University. The corresponding software works on Windows 98/2000/NT and is available from our web site [13]. The synchronous writing clinic is currently integrated with a complementary *asynchronous* writing environment--an interactive English writing system in IWiLL used by over 200 English majors and six English professors at Tamkang University. The resulting system constitutes a novel multifaceted writing environment for second language learners and teachers.

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The Development of a Multimedia Program for Teachers to Integrate Computers into the English Curriculum

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A self-learning multimedia program was developed for English teachers' professional development in the integration of computers into the English curriculum. This program consists of four parts: (1) study guide (2) application cases (3) computer resources, and (4) related documents. In addition, a tool box is provided to gain access to a word processing system for taking notes, or to connect to a network discussion system for ideas exchange. This program was found satisfactory based on a preliminary evaluation. However, it will be upgraded continueously in the future. At the same time, a detailed study will be followed to investigate the effectiveness of its use.

Keywords: **Multimedia, System development, ESL teaching, Teacher professional development**

1 Introduction

It is said that the use of computer technology can create authentic and rich learning environments where learners' communication skills in English may be enhanced greatly.[1][2] To have such benefits, it is important to integrate computers into the English curriculum. In so doing, many factors such as computer technology, subject matters, learners, and even the environments all need to be taken into consideration. Above all, the key factor to successful integration is the school teacher. Teachers eventually need to take the responsibility of determining when and how to use computers, and assessing the effectiveness of computer use with their students.[3] However, a survey report in 1999 by the National Center for Educational Statistics still indicated such problem since only less than 20% of current teachers in American reported feeling very well prepared for technology integration.[4] The teachers in Taiwan also have the same problems. Neither do they know what kind of computer resources available, nor do they know how to apply them to their classroom instruction. In view of this, a multimedia program was developed for middle school English teachers so as to increase their competence and confidence in the instructional use of computers, and consequently to help them integrate computers into their instruction.

In the age of information technology, teachers are required to learn about technology. On the other hand, technology can be used to promote teacher professional development. For example, Hawkes proposed the use of network-based communication for teachers to gain access to professionally relevant knowledge.[5] However, the network installation is more complicated compared to that of cd-rom. Furthermore, the quality of Internet transmission for large amount of data such as videos is still below our satisfaction. Therefore, this multimedia program for English teachers currently resides on a cd-rom instead of a web site. However, technical support is available via telephone calls or e-mails. In addition, teachers can share ideas with others by connecting to a network discussion system.

2 The Developing Process

The Systems approach to instructional design has been adopted to guide the production of this multimedia program and thus to ensure the quality of its end product. [6][7] On the whole, the process includes four phases, namely, analysis, design, development, and evaluation/revision.

2.1 Phase of Analysis

Based on the review of the literature, there is a need to enhance teachers' willingness, competence, and confidence in the use of computers in their English classrooms. Due to the advantages of convenience and flexibility, a self-learning multimedia program is proposed. Basically this program attempts to achieve the following goals: (1) to stimulate teachers to rethink the new roles of teachers in an information society, (2) to help teachers understand the principles and strategies of the classroom use of comoputers, and thus generate some possible ways of applications, and (3) to encourage teachers to follow the application cases and lesson plans provided by this program and actually apply computers to their classroom instruction

2.2 Phase of Design

After several discussions with English teachers, English teaching experts, and instructional designers, a framework of this program is finally settled as shown in figure 1. The "study guide" gives an overview of the program' s goals, operation procedures, and contents to help users get an overall view of this program in a short time. Thus the users are able to decide the best way to use the program to meet their own needs. The "application cases" provides several cases about teachers' classroom use of computers in English teaching. Since these cases are realistic, it is believed that they would give teachers strong inspirations and implications. Each case contains useful information including: (1) background of the school and the teacher, (2) lesson plan of using comp uters in his or her classroom, (3) "teaching on the spot" in the video format, (4) student reactions based on the questionnaire and interview data, (5) teacher reflections about this practice, and (6) related issues pointed out by the designer.

The "computer resources" lists the titles of cd-roms and web sites useful for English teaching. The publisher of each cd-rom and a short description of its content are provided. The address of each web site, a short description of its content, and the computer screen of its homepage are displayed. The "related documents" includes a set of helpful information regarding implementing computer technology. For example, the "future education" outlines schools, teachers, and English teaching in the future. The "use of computers" describes the strengths of computers, identifies types of applications, and presents samples of lesson plans. The "user guide" points out the issues of intelligence properties and computer ethics. It also includes software evaluation sheets. "The Imp lementation guide" reminds teachers of some factors that need to be taken into consideration in implementing computers in their classrooms. Finally, the "references" lists the titles of related articles and books so that teachers can get more detailed information if needed. In addition, a tool box is provided to gain access to the word processing system for teachers to take notes whenever they need, and to connect to a network discussion system for ideas exchange and sharing.

2.3 Phase of Development

The programming tool for this multimedia program is Authorware 5.0, and the program resides on a cd-rom to enable easy distribution. To collect the data for the "application cases", the whole teaching process of each case is video taped. Afterwards, the teaching process is divided into several steps. Accordingly, suitable video screens are selected for each step. These video screens are then transformed and stored in mpeg files. At the end of instruction, the student is asked to fill in an attitude questionnaire. Furthermore, the teacher and several students are interviewed. The whole questionnaires are then analyzed statistically, while the interview data are examined in depth.

2.4 Phase of Evaluation/Revision

English teachers, English teaching experts, and instructional designers are invited to participate in a preliminary evaluation of this program. The focus of this evaluation includes content, screen design, media effects, interface design, and system operations. This program will thus be revised and expanded according to their opinions and suggestions. In the future, a detailed study will be followed to investigate the effectiveness of its use.

3 Results and Discussion

Based on a preliminary evaluation reports by two English teachers and one instructional designer, it was found that the program's content is plentiful and practical on the whole. Moreover, the screen design is of high quality, the interface design is user friendly, and the program's operation is easy and consistent. However, some of the video screens in the "application cases" look gloomy. Sometimes, it takes efforts to identify the key plot of these screens. Finally, it is suggested to increase the quantity and variety of the cases in this program.

In regard to the quality problem of the video screens, it is because the teacher turned off all the lights in the classroom to make more readable the computer displays by a portable projector. Consequently the quality of video recording was affected. As to the small number of the cases, it is because few English teachers ever used computers in their classrooms. Most of them dare not try it. The availability of the computer hardware is another problem. At that time, there was no computer lab available for English teachers. Therefore, the three cases currently included in this program all occurred in the regular classrooms where cd-roms, a notebook computer, and a portable projector were used.

To increase the quantity and variety of the cases in this program, two cases are collected afterwards. The two cases all occurred in the computer labs. In addition, e-mails and Internet resources were used. The program will be upgraded continueously in the future. At the same time, a detailed study will be followed to investigate the effectiveness of its use. Questionnaires on computer literacy, and attitudes toward this self-learning program, as well as the design of lesson plans will be used to collect the outcome data. The net discussion tracking system, and the journal writing will be used to collect the process data. In addition, relevant suggestions will be provided regarding optimal strategies and necessary supports which go well with the use of this self-learning multimedia program.

4 Conclusions

A self-learning multimedia program was developed for English teachers' professional development in the integration of computers into the English curriculum Based on a preliminary evaluation, the program was found satisfactory. However, it will be upgraded continueously in the future. At the same time, a detailed study will be followed to investigate the effectiveness of its use.

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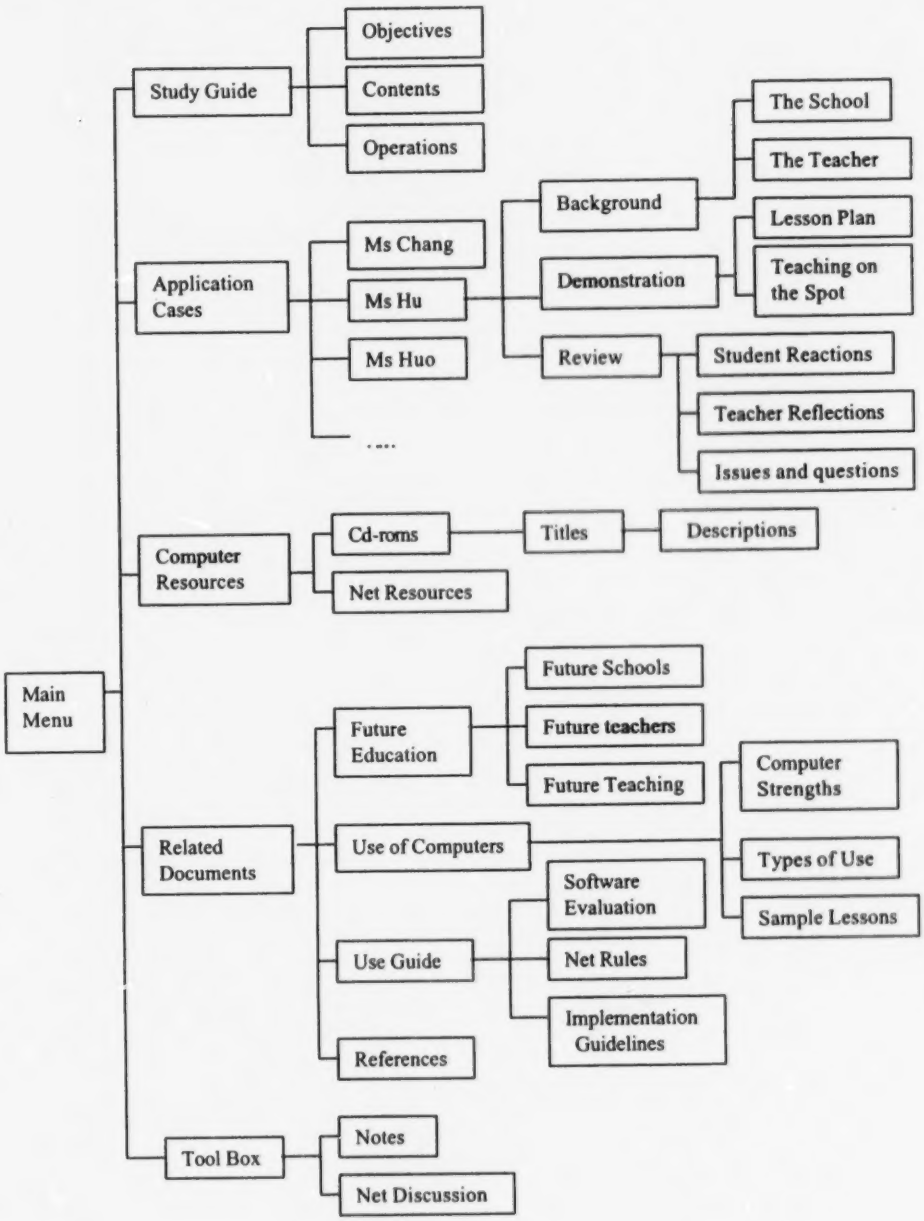

Figure 1 Framework of the multimedia program
Figure 1 Framework of the multimedia program

The effectiveness of integrating adaptive computer device and stimulus fading strategy on word-recognition for students with moderate mental retardation

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The purpose of the study is to examine the effectiveness of the instruction method involving computer device and stimulus fading strategy on word-recognition of two fourth grade students with moderate mental retardation enrolled in a special school. A single subject multiple probe baselines design across subjects is used. The students use the U1 system as the adaptive computer interface to learn word-recognition with the picture cue fading and the word enlarging. The result shows that both two students can identify the four print words correctly, even in different fonts and in different writing ways. The advantages of the adaptive computer interface and stimulus fading strategy are supported.

Keyword: **adaptive computer system, stimulus fading strategy, special education, mental retarded**

1 Introduction

It is getting more important to enhance everyone's reading ability in the information age, including individuals with mental retardation. Reading is a very complex process that involves at least two components, word recognition and comprehension. Word recognition is the base of comprehension [3]. To improve the ability of word recognition has been a hot topic in literature and research [5] [6] [8].

The goal of education for individuals with mental retardation is to help them to adapt to society. So the ability of word recognition is important for them too. In Taiwan, how to teach students with mental retardation to acquire reading skill was not noticed until recently, though the curriculum guide for students with mental retardation in Taiwan has emphasized that the practical language course should help students to learn functional Chinese. However, if we want the individuals with mental retardation to integrate into the mainstream society after they leave school, we should teach them to learn to identify the functional word as early as possible.

In practical, teachers usually use pictorial cues as reading instruction strategy to reduce task complexity, increase motivation, and lead to reading success [8]. The researcher in Taiwan also found that using pictorial cue could enhance the effects of word-recognition of the students with mental retardation [10]. But Pufpaff,

Blischak, & Lioyd indicated that some researchers found these methods were ineffective [8], the main problem is that students could not transfer their attention from pictorial cue to word when picture was absent [9].

Word-recognition is a sort of skills learned by way of stimulus discriminatory learning [1]. Sometimes, it needs to add some kind of stimulus (or control stimulus, prompt) that could assist the individuals to express expected response. Once the individual could respond correctly and stably under the prompt, the prompt should be moved gradually [1]. There are two types of instructional prompts, response prompts and stimulus prompts [1]. Using pictorial cues is one kind of stimulus prompts. That may be an effective strategy that we can use pictures as a prompt to teach individuals with mental retardation to learn to identify the target words, then move the pictorial cue systematically once the individuals could differentiate the target words correctly when the pictorial cue is existing. Sue concluded that stimulus prompts was an effective instruction method on word recognition for students with moderate mental retardation after she had analyzed a great deal of related research [9]. The result of Sue's research, using stimulus fading strategy to teach the three second grade students with moderate mental retarded to learn the specific functional Chinese words, showed that the students could learn effectively and efficiently.

In the past, including Sue's study, most of the special educators who use stimulus fading strategy to teach word-recognition create the cards which were composed of picture and word according to the principle of fading. The instructors should teach and provide the feedback by themselves, and the material couldn't be reorganized. As the computer has been more available in the classroom and the Department of Education in Taiwan has begun to purchase adaptive computer devices for students with disabilities, it facilitates students with mental retardation to study through computer and related adaptive devices. The multimedia could provide the feedback automatically and multi-sensory learning opportunity, and on other hand, the adaptive computer devices could help the students to overcome the interface barrier.

In fact, technology could assist the students with disabilities to learn literature effectively [4]. So could we design a computerized instruction program that embeds stimulus fading strategy and adaptive computer device to teach students with moderate mental retardation effective and efficiently?

2 Method

2.1 Participants and setting

Two students with moderate mental retardation on the fourth grade in the Chia-Yi special school participated in this research. The participants were selected on the basis of three criteria. First, they were capable to use verbal communication. Second, their emotions were stable. Third, they had a history of experiencing difficulties in recognizing words that were taught on their classes.

The IQs were obtained from WISC-Ⅲ, which were administered by the first researchers prior to the beginning of the study. In order to realize the participants' characteristics, the researchers reviewed their IEP files and interviewed with their teachers. A summary of the participant's characteristics appears in table 1.

Table 1
Participants Characteristics

Participant	Age	Gender	IQ(WISC-Ⅲ)	Performance of speech
A	10	Male	Full-Scale IQ:57	Articulation disorder
			Verbal IQ 58	Received speech-language therapy.
			Performance IQ 64	About 4 words phrases
B	11	Male	Full-Scale IQ:	Articulation disorder
			Verbal IQ	received speech-language therapy
			Performance IQ	About 2 words phrases

Both of the students had speech disorders and received speech therapy. Student A could answer to the

teacher's question in a short sentence, about four words. Student B was able to use 1-2 words to response teacher's questions. Although the two participants usually paid attention to the teachers on the class, and could do well on the task of picture matching, however, they could not recognize a word after the reading program.

Instruction was conducted by the researchers in the school's counseling room. A personal computer with an U1 computer interface system was placed on the table. The U1 system was designed by Assistive Technology Foundation. It is a kind of programmable keyboard that could be designed by the instructor [2]. The participant was sitting in front of the table and operating the U1 system when the instruction was proceeding.

2.2 Stimuli

Four functional Chinese characters were decided after the researchers discussed with the participant's teachers on the schedule of the reading program. The researchers used the editor of U1 system to create the layout of a printed page after the four target words were chosen. There were two frames on each page. All pictures and words were edited in the center of 11cm x 16cm frame. The word was printed vertically and located above the picture. According to the stimulus fading strategy, each target word was selected in 50-point, 100-point and 130-point Ming type, and the picture was set in 10cm x 10cm, 4.5cm x 4.5cm, 1cm x 1cm. Besides these three kinds of layout, there was another layout that was only 130-point words on it.

In order to avoid the participants to response to the stimuli on fixed location, each word was presented on both sides on different layout. So the researchers designed 10 pages for each fading step, 40 pages for the instruction. Additionally, the researchers designed the other 10 pages that presented the target word alone that were printed in 130-point Kai type to measure the generalization of different font, and 4 pages that was printed horizontally for testing the generalization of different printed direction.

For the purpose of multiple sensory learning, the researchers set up some functions for each frame. The computer would speak out the target word, show the picture of the target word, and then present the target word on the screen when the participant touched the frame on the layout on the U1 system during the instruction.

2.3 Definitions of independent and dependent variables

The independent variables were stimulus fading strategy and the using of U1 computer interface system.

The dependent variables were effectiveness (percentage of correctly identified target words) and efficiency (percentage of wrong response to mastery, and number of session to criterion).

2.4 Design

A multiple probe baseline across subjects was used to assess the effectiveness of integrating U1 system and stimulus fading strategy on word-recognition for the elementary students with moderated mental retardation. The particular strengths of the multiple probe baseline design were: (a) the treatment was not reversed, (b) prolonged baseline measures were unnecessary, and (c) the design permitted the evaluation of academic learning [1]. A constant time delay technique was selected for instruction in this study, and oral praising was used as the reinforcement.

2.5 Procedure

Each participant had two learning sessions (one was in the morning, the other was in the afternoon) each day from Monday to Thursday. In order to balance the effect sequence of instruction, researchers decided which participant would accept instruction randomly prior to the instruction, and decided the sequence of the instruction on each day after both participants attended the instruction.

2.5.1 Baseline

In the baseline period, the participants were tested about their familiarity with the target words. The students were asked to point out the word under researcher's order. During the baseline assessment, the researchers

did not give participants any feedback or promotion, but recorded their response. The percentage of correct response counted after testing each word five times was used as the participant's baseline performance.

2.5.2 Instruction sessions

Prior to instruction, researchers divided the four target words into two groups and decided which group would be taught at the beginning. 'Hospital '(醫院) and 'drugstore'(西藥房) were taught at first, then ' an internal medicine' (內服藥)and ' an external medicine'(外用藥).

Student A attended the step one instruction. Researchers put the 50-point layout on the U1, and read the target word, then ask students A to read the word and touch the target frame. If he could touch the frame correctly in 4 seconds delay period, the researchers said" you did a good job" as the reinforcement and go on the next target word. Others, the researchers would demonstrate the correct response and ask student to do it again. The correct response would be recorded when the student did it by himself. The percentage of correct response was counted after each word was tested five times. The student would not go to the step two instruction until he reached the master criteria, 80% correct response in the continued sessions. Then the instruction procedure would repeated till the participant could discriminate group one words with no pictorial cues. Then went on group two.

The student B would attend the instruction when student A could discriminate the words of group one stably and had the same procedure.

2.5.3 Maintenance and generalization

In order to examine whether the participants could maintain their word-recognition abilities, and generalize it to the different font and written direction. We continued to assess the participants' performance after the instruction sessions and presented the other layout with different font or written direction.

2.6 Reliability

In order to assess the participants' response accurately, we set up a function of the U1 editor to write the participant's answer into the *Microsoft EXCEL* automatically when they touch the frame of the layout on the U1.

3 Result

3.1 Instruction

The percentage of correctly identifying the four target words during the instruction sessions for each participant is presented in Figures 1 and 2. For these two participants, it is obvious that instruction integrating stimulus the fading strategy and the U1 computer interface system was a effective method to teach students with moderate mental retardation to identify these four target words. Both of them could reached criterion during in each session , excepted student B in learning 'drugstore' with no pictorial cues on step four on the first time .

The results for student A (see Figure 1) illustrate that he could identified each target word to 100% correctly in each fading step. It means that he did not have any difficulty in word-identification when the cues were faded. Contrarily, Student B encountered more problems in step 4, excepted ' an internal medicine'.

At the beginning of this study, we set up the criterion for fading the pictorial cue as participant could identify the target word correctly 80 % in 3 consecutive sessions. So there should be 12 sessions (4 steps and 3 sessions for each step) in need for the participant to reach the criterion that identifies the target word with no pictorial cue. The results in Figure 1 and 2 indicate that both of these two participants reached the criterion, excluded 'internal medicine ' for student B. It means that participants could learn efficiently.

3.2 Maintenance and generalization

Performance during the maintenance period shows that these two participants demonstrated great availability.

Both of them could identify the target words almost 100% correctly, excepted 'internal medicine' for student A and 'external medicine' for student B.

The outcome of the generalization is presented in table 2. two participants could identify the target word in Kia type in stead of Ming type in instruction, and recognize the word printed horizontally regardless of verticality at beginning of the instruction.

Table 2
Percentage of correct response of generalization

Participants	Target word	Printed in Kia type	Printed in horizontal direction
A	Hospital	100%	100%
	Drugstore	80%	100%
	Internal medicine	100%	80%
	External medicine	100%	80%
B	Hospital	80%	100%
	Drugstore	100%	80%
	Internal medicine	100%	100%
	External medicine	100%	100%

4 Conclusions

The purpose of this study was to examine the effects of integrating adaptive computer device and stimulus1 fading strategy on word-recognition for students with moderated mental retardation enrolled in 4th grade in a special school. The results indicated that both two participants could identify these four target words without pictorial cue. In other words , integrated adaptive computer input device and stimulus fading strategy could be an effective instruction method for the students with moderated mental retardation to recognize some functional Chinese characters. The results of this study is similar to Sue's study in 1992, she found stimulus fading was an effective strategy to teach students enrolled in the self-contained special class in elementary school to identify the functional Chinese characters.

According to the results of this study, special education educators can teach student to identify new Chinese characters by multi-media computerized instruction that use the adaptive computer input device, U1 system, as the interface and the stimulus fading as the instruction strategy.

Although this study indicates that participants could recognize the target words, it still could not offer enough evidences for us to realize if they could learn to identify each single word through this way. This is an issue worth exploring further.

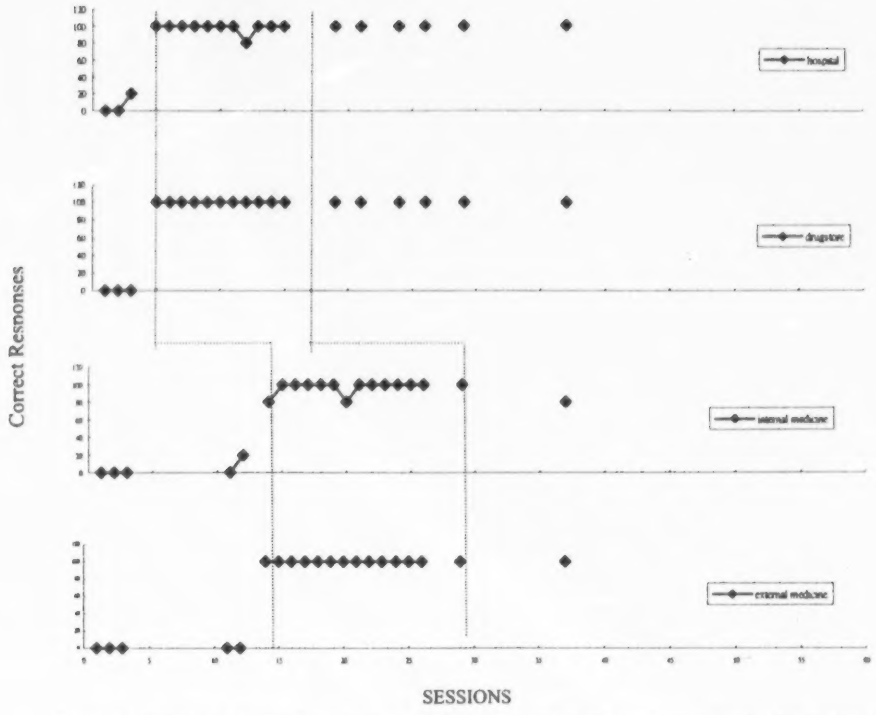

Figure 1. Percentage of correct responses during instruction period and maintenance period for student A

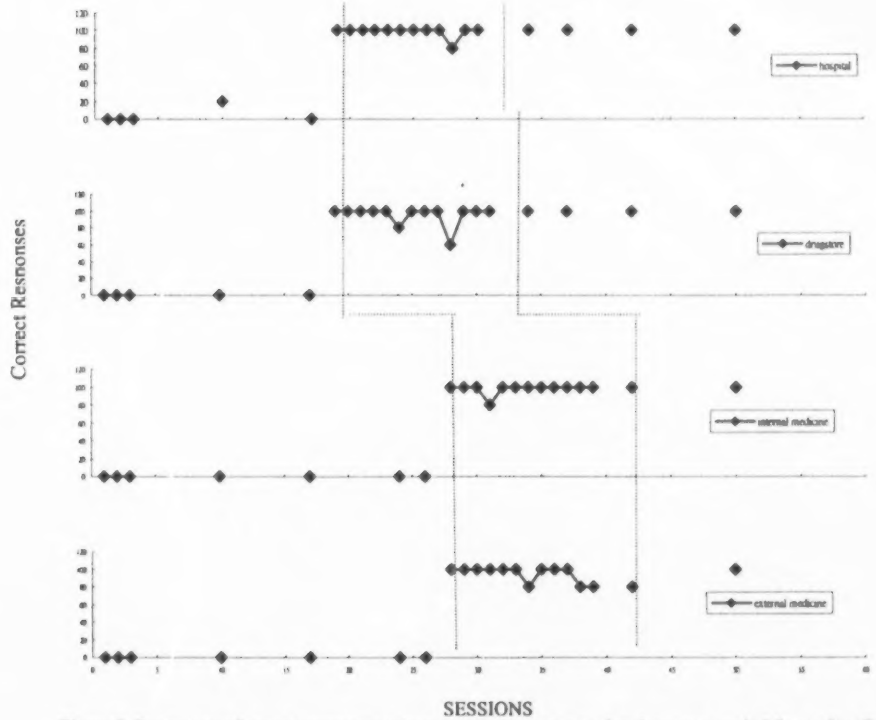

Figure 2. Percentage of correct responses during instruction period and maintenance period for student B

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Using electronic bulletin board as a virtual community to aid college English learning

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With the rise of computer network, Computer-Mediated Communication (CMC) is now gaining more and more attention in the English-as-a-second language or English-as-a-foreign-language (ESL/EFL) field. It is claimed that CMC promotes learner empowerment and literacy on the basis of collaborative learning. Although some research has been conducted on the effect of synchronous conferencing on foreign language leaning, very few empirical studies have been conducted using asynchronous conferencing except the use of electronic mail in Taiwan. Bulletin Board System (BBS), among them, becomes a very prevalent CMC activity for college students in Taiwan. This present project aims to explore how BBS forms a virtual community to facilitate college English learning.This project was conducted in the fall semester of 1999 with 45 college freshman students in a general English class. An electronic bulletin board was built for this class only and activities on the board were integrated into the class learning. During the semester, free postings on this bulletin board outside of class time were encouraged, and two tasks serving as instructional interventions were required of all students to post to the board, followed by class debriefing. Additionally, two writing tasks with on-line pre-writing discussion on the board were interleaved with another two writing tasks without on-line discussion—serving as controlled tasks. The two sets were both followed by in-class pre-writing discussion before they actually wrote in class. The first set served as practice sessions. All the writings in the second set were holistically graded by two raters using the ESL Composition Profile. T-tests were used to compare the part scores (content, organization, language use, vocabulary, and mechanics) and total scores of the compositions between sessions. A Background and an Evaluation Questionnaire were used to obtain students' computer literacy and attitudes toward such use of the board. An interview was conducted with the class instructor to obtain data from her perspective. All the postings on the board were categorized according to topics and situations with frequency counts. How topics were elaborated and changed was documented. Detailed results and conclusions were reported and pedagogical implications were discussed.

Keywords: **asynchronous conferencing; Bulletin Board System; CMC; college English learning; virtual community**

1 Introduction

Since 1970s, computer network has become a new medium for communication. In view of significant communicative functions of computers, the educational fields, including the field of computer-assisted language learning (CALL), have paid more and more attention to computer-mediated communication (CMC)

on the belief about "language as communication" and the mediational function of computer network (Bruce & Levin, 1997; Cooper & Selfe, 1990; Zhao, 1996). The Bulletin Board System (BBS), one type of asynchronous conferencing, is now a significant CMC activity for college students in Taiwan, Republic of China. It provides an environment for users to exchange ideas, download files, chat, etc. to fulfill communications and social interaction functions. Moreover, from the perspective of computing cost, BBS is superior to other network facilities because it runs under the Unix and DOS environments and thus is faster than the operations under the Windows environments. Based on the merits mentioned above, BBS has become a prevalent electronic tool on college campus since the Taiwan Academic Network was established in 1992.

However, though BBS is a popular medium for communication among college students, it is usually negatively evaluated for some reasons. Due to the anonymity on BBS, conflicts, flames, imputations, etc. resulting from users' wordy warfare on the BBS are always the troubles during the process of communication. Besides, teachers in Taiwan always regard BBS as a time-wasting activity for students. They claim that many students are seriously addicted to BBS so that they neglect their schoolwork and fail courses. Nevertheless, because BBS possesses the characteristics of asynchronous conferencing via computers, it has the potentiality to be applied to the educational field. The pros and cons for using BBS for college teaching in Taiwan require empirical research to verify.

So far, there is not much done on BBS-assisted language learning and almost none in Taiwan, based on our review of the literature. In view of lack of studies about the effects of BBS on English learning in Taiwan and the popular of BBS on college campus in Taiwan, this study aims to explore how BBS forms a virtual community to facilitate college students' writing. There are three specific research questions to be explored in this study:

(1). How do college EFL learners take advantage of a class-based electronic bulletin board to aid their English writing? Would members in this class extend such a "learning community" beyond the classroom to learn English writing and other aspects?

(2). Does asynchronous on-line pre-writing discussion on BBS help college EFL learning?

(a). Does asynchronous on-line pre-writing discussion facilitate the in-class pre-writing discussion?

(b). Does asynchronous on-line pre-writing discussion improve EFL learners' writing quality? If it does, what aspects would it benefit?

2 Literature Review

2.1 CMC and Collaborative Learning

For the last several decades, collaborative learning has become the focal point in the English teaching field. Vygotsyky (1978) emphasizes that interacting with people of variant proficiency levels helps one make progress on his or her "zone of proximal development". Zhao (1996) reclaims the importance of apprenticeship learning for language learning. He mentions that "Learning a second language is thus a process in which the learner develop skills and knowledge necessary for becoming a full member through participating in the practice of the multilingual community" (p. 44). In other words, second language learners are supposed to become fully literate in a community by directly and peripherally participating in activities within a community in the target language. That is to say, language learning is not an isolated skill but a process of socialization.

With the mediational functions, CMC is of benefit to collaborative ESL/EFL learning. Because participants in CMC activities are linked together via the computer network, CMC helps create cyberspace in which network users may form members of a discourse community (Kollock & Smith, 1996; Korenman & Wyatt, 1996). Warschauer (1996) indicates that "sense of community" is beneficial for student empowerment, including student autonomy, equality, and learning skill. Therefore, exploring how CMC helps learner empowerment and literacy on the basis of collaborative learning is full of potential in the ESL/EFL field. Nevertheless, most previous research about CMC and language learning focuses on the effects of synchronous conferencing or e-mail. As for asynchronous conferencing via BBS, it still remains under-researched in CALL.

2.2 BBS for Foreign Language Learning

BBS, an essential service of CMC, provides an environment for people to exchange messages at their convenience. The most convenient about BBS is that it does not require participants to log on the network at the same time. Participants are allowed to read or send messages at any time they like because the posted messages would be stored for a certain period of time on the server or local mailbox. Generally, BBS provides at least four basic functions: files transmission, chatting, mail exchanging, and discussion. Among these functions, discussion is the major function of BBS. Each BBS has many bulletin boards, such as sports, music, food, computer games, etc., like the discussion groups on the Usenet. BBS users could connect to a specific BBS and find whatever bulletin board interests them. Then, they might read messages posted by other users, respond to posted articles, or cast personal questions.

Discussion on BBS acquires some features helpful for English learning and commonly found in other media for asynchronous conferencing. First, asynchronous conferencing is public exchanging, so messages and ideas transmitted via asynchronous conferencing are shared by a group of people. Once ESL/EFL learners are required to complete collaborative activities in the target language via asynchronous conferencing, they would acquire opportunities to communicate with real audience for authentic purposes. In this way, learners would become more motivated to learn English because they would realize that they learn English for authentic communication not for examinations. Second, like other tools for asynchronous conferencing, BBS may encourage equality of participation. Kroonenberg (1994/1995) find that students are more risk-taking when they discuss on BBS because they are allowed to hide behind the computer screen to express personal opinions. In this way, some social factors, such as gender, social status, personality, age, etc., would be reduced. Given chances to complete discussion on line, ESL/ EFL learning might turn into more student-centered.

Third, on-line discussion is beneficial for pre-writing activities. Warschauer (1996) indicates that "electronic discussion can be a good environment for fostering use of more formal and complex language, both lexically and syntactically" (p. 22). Language used in computer conferencing is more complex than the spoken text. For this reason, ESL/EFL learners would have chances to practice more formal language usage and language use on line than in face-to-face discussion. Fourth, asynchronous conferencing is free of time and space. It allows extending the "learning community" beyond ESL/EFL classrooms. Participants could retrieve or send messages whenever they are available. For this reason, learner autonomy would be enhanced; in addition to formal in-class instructions, learners are also permitted to learn English at their own pace off class. Fifth, the competition for turn-taking in traditional classrooms is reduced in asynchronous conferencing, so participants may get more time to think over their ideas and re-edit their messages. Once EFL learners have opportunities to discuss asynchronously, they are allowed to express ideas thoroughly without being interrupted during their turns. This characteristic would help those who are not orally fluent because they could eschew nervousness resulting from interruptions during the thinking flow. Last, BBS needs cheaper network connection, so BBS users could be free from the trouble caused by the traffic jam for real-time connection flow.

Although the BBS has characteristics of CMC which are helpful for foreign language learning, very few empirical studies about the effects of BBS on language learning have been conducted so far. Many studies all show positive values about discussion on BBS or on the mailing list for foreign language learning (Kroonenberg, 1995; Paramskas, 1995; Razika, 1995; Kroonenberg, 1997; Van Handle & Corl, 1998). Discussion on the BBS is reported to facilitate oral discussions in classrooms and empower some aspects of writing proficiency, such as language usage and creative thinking. However, most of the evidence come from personal observations of researchers and comments from students, there is no systematic and solid evidence showing to what extent discussion on BBS helps students make progress on their language proficiency, such as writing, reading, and thinking skills. Research that collects experimental comparison data to know about how asynchronous conferencing like the BBS facilitates learners' language skills or language proficiency is extremely needed and helpful to the profession.

In recent years, "discussion" is paid more and more attention to in ESL/EFL writing classrooms because it facilitates collaborative learning. Writing is regarded as not only an individual task but also a process of socialization. ESL/EFL learners are expected to become the competent writers who know how to write to learn and learn to write during the process of writing via discussion. With the rise of computer network, some researchers have applied synchronous on-line discussion to writing classrooms (Sullivan and Pratt, 1996; Warschauer, 1996; Huang, 1998). Huang (1998) further suggests pre-writing discussion be done on line besides being in class; thus, learners would gain more time to express ideas thoroughly. With the merits mentioned above, BBS is supposed to have the potential to provide English learners a suitable virtual

environment for discussion and serve as a beneficial aid for their learning of English writing. Due to the lack of systematic and empirical studies about using BBS for English learning in Taiwan, this present project will be conducted to explore how it will benefit college ESL/EFL learners' writing in Taiwan.

3 Methods

3.1 Participants

Participants involved in this project were 45 students in a Freshman English class, an instructor for the class, and an MA-TEFL graduate student. Over 60% of the students had the experience of using BBS for at least one year before this project was conducted. The students in this project were newly enrolled college freshmen of Computer Science in the fall of 1999. In this project, these students, who were from an intact group, took Freshman English as a required course in their college curriculum. This class met together once for two hours a week. Before these students entered college, they all had received formal English instruction for at least six years during their high school education. Most of them could read articles of complex syntactic structures and had had some practice on writing English articles of 120-150 words in their senior high.

3.2 The Learning Medium and Instruments

An electronic bulletin board was built as a supplementary learning medium for this Freshman English class. This bulletin board was built on the BBS of the Department of Materials Science & Engineering on campus. To get access to this bulletin board, it was necessary for participants in this project to find a computer which offered the service of network connection. Because the network facilities at the National Tsing-Hua University were adequately comprehensive, it was convenient for all the participants to gain access to the bulletin board on campus. Members in this class were allowed to take advantage of this bulletin board off class, so they might check entries or post messages at their convenience. The instructor announced messages for the whole class on this bulletin board. All the participants discussed whatever issue interested them on the board. Moreover, students wrote free journals, shared feelings, posted their works, or responded to others' ideas on this bulletin board. What important is that all the postings on this bulletin board were written mostly in English, sometimes in Chinese, to provide chances for this EFL class to make authentic communications in English.

Two questionnaires were designed to survey students' background and their attitudes toward using the class board. A Background questionnaire with 16 items was used in the beginning of the semester to gain some information about students' experience of English learning and using BBS. An Evaluation Questionnaire of 17 items was used at the end of the semester to evaluate whether this electronic bulletin board helped students' English learning: specifically, how they used this discussion forum and to what extent this discussion forum helped their English learning, especially English writing.

3.3 Instructional Design and Research Procedures

This project lasted for one semester--18 weeks. During the semester, in addition to free postings on this bulletin board, some activities were designed to encourage students to take advantage of this electronic bulletin board. The research procedures included three stages. At the first stage, i. e., the first week of the class, orientation activities were designed as warm-up of this BBS project. Students were asked to complete Background Questionnaire, request an individual account from the BBS administer, write a short self-introduction in English, and post the self-introduction to the bulletin board during the first week.

At the second stage, some English writing activities were designed to encourage students to utilize this discussion forum. Four writing activities were directly associated with evaluating effects of this class-based BBS on English writing. These four writing activities were divided into two sets: one for practice (P) and the other for formal evaluation (F). The P set aimed to help students become familiar with the process of writing; the F set was the source of data analysis for this project. Each set included two writing activities: besides in-class discussion and writing, one had on-line pre-writing discussion (OL) and the other had no on-line pre-writing discussion (NOL). The four writing activities in this project were referred to as PNOL, POL, FOL, and FNOL. During the writing activity, students got some guiding questions one week before in-class writing. They had to carefully think over those questions and prepare for the in-class discussion and writing

in the following week. In POL and FOL, students were additionally required to discuss guiding questions on the BBS during the week. When the day for writing came, students had to participate in the in-class pre-writing discussion for about 15 minutes first and then completed an in-class essay within 30 minutes. The topic for each writing task was assigned in class and related to the guiding questions students had discussed. All students' writings were graded and then returned with some marks for revision. As for the writing activities of the P set, they were quite similar to those of the F set. These four writing activities lasted for almost two months and the order of them were PNOL, POL, FOL, and FNOL.

In addition to these four writing activities, another two writing activities were taken as instructional interventions during the rest of the semester to promote participation on BBS. In the twelfth week, students were assigned to read an article off class and they had to connect to the BBS to answer two reading comprehension questions on the BBS. Two weeks later, the class appreciated a movie--*The Little Buddha*--in class. Students were required to write a short summary for this movie on the BBS off class. After students completed each of the two activities, the teaching assistant debriefed students' BBS postings in class in order to lead students to review some good ideas or excellent works. These instructional interventions aimed to encourage students to utilize the BBS more frequently and more interactively. At the third stage, i. e., the last week of the class, the Evaluation Questionnaire was employed to assess students' attitudes about the BBS on their EFL learning, particularly English writing.

3.4 Data Analysis

In order to evaluate how this class-based bulletin board aided students on their English writing, we conducted both quantitative and qualitative analyses. Firstly, we investigated how participants in this project extended a learning community beyond the classroom to learn English from the perspectives of the instructor, the researcher, and students. Students in this project completed the Evaluation Questionnaire at the end of the semester to help us understand how students evaluated the bulletin board as a learning aid. At the last week of the semester, the researcher also had an interview with the instructor in order to understand to what extent the instructor regarded BBS as a useful teaching aid. In addition, the researcher counted frequencies of posting, categorized postings, and traced the interaction of postings in order to know how participants utilized this discussion forum.

Secondly, by interviewing with the instructor, the researcher acquired the instructor's feedback towards students' in-class discussion in FOL and FNOL writing activities. Also, the researcher kept some diary about the classroom observation during the FOL and FNOL in-class discussion. Students responded in the Evaluation Questionnaire to show to what extent the pre-writing discussion helped their FOL in-class discussion.

Thirdly, students' in-class writings of FOL and FNOL were assessed using the ESL Composition Profile in *Testing ESL Writing: A Practical Approach* (Jacobs *et al.*, 1981) by two raters. The ESL Composition Profile is comprised of five scoring parts: content, organization, vocabulary, language use, and mechanics. For each part of the assessment, there are detailed criteria provided. The two raters are both graduate students: one is a TEFL major and the other is a linguistics major. Both of them were foreign languages majors in college. To make the grading as objective as possible, two raters practiced their grading for the writings in the practice session so that they could adjust the discrepancy in order to increase the reliability of the rating. Last, t-test was employed to compare total scores and the five part scores between papers with online pre-writing discussion and those without online pre-writing discussion.

4 Results and Discussion

4.1 BBS as a virtual English learning community

Totally, participants involved in this study posted 408 entries, including 353 postings required as assignments (86.5%) and 55 postings unrelated to assignment requirements (13.5%). During the semester, we expected students to post more self-initiated entries on this discussion forum. However, self-initiated postings were apparently fewer than assignment-directed postings. In some weeks, there was even no self-initiated posting found on this discussion forum. Nevertheless, after the 18th week—the last week of the semester—still four more self-initiated postings were found. It implies that although the majority of the students regarded this class-based bulletin board as assignment-oriented, this discussion forum did have an

impact on some of the students in the ense of being a member in a community.

Generally speaking, participants in this project did not utilize this class-based bulletin board frequently. Except for the researcher, who was required to check entries on BBS every 2 to 3 days in a week, the instructor used to browse postings every two weeks, and most of the students tended to visit this discussion forum only when they had to hand in homework on line. These could be confirmed by the Evaluation Questionnaire results. Around 60% of the students in this class regarded playing BBS as a necessity in their college life; however, on average, nearly 70% of the class browsed this specific class-based bulletin board only 0 to 3 times a week. About 20% of the students claimed that they did not browse this discussion forum carefully. Except handing in homework, they were not interested in utilizing this class-based board for any purpose; sometimes, they would even refuse to post homework on BBS. Besides, only 25% of the students would check almost every posting on BBS. The results above show that most of the participants in this class did not become voluntarily involved in this BBS-project yet; many of them merely regarded this discussion forum as a place for assignment display and they did not become used to share life experiences in English on BBS yet.

Originally, we expected that asking students to post an original message and respond to at least one classmate's message could stimulate more discussion on others' on-line essays or comments. During the semester, we found that around 80% of the students indeed had fulfilled the requirements of the writing project. However, almost none in this class attempts to post additional entries except for the required postings. The majority of the students tended to view replying to others' postings as merely an "assignment" or a "task". Once they completed the task, they did not attempt to give additional responses to others' message. Thus, there were few interactions among the assignment-directed postings; in contrast, more interactions emerged among self-initiated ones.

All the self-initiated postings are divided into two main categories: original postings, including postings related to assignments (feedback, announcement, and assignment reminding) and postings not related to assignments (classroom management, extracts[1], experiences, and blessings), and responses (postings replied to original postings). The majority of teacher's postings were associated with classroom management (42%) and responses (33%). The teaching assistant's postings focused on responses (38%) and extracts (31%). As for students' postings, a large proportion of them were responses (55%) and many of them were about student's personal experiences (26%). It indicates that participants in this class seemed to take advantage of this class-based BBS for different purposes. Being the conductor of the class, the teacher tended to pay more attention to issues related to classroom management in order to keep the class in order. The teaching assistant was inclined to post extracts or reply to students' postings in order to trigger students' motivation of using the BBS and promote interactions on BBS. Also, we learn that more than half of the students' postings were responses. Compared with students' performance on assignment postings, students' performance on self-initiated postings seemed more active because students were not required to respond to others' self-initiated postings but they did and responses were of more interactions.

Students' greater interaction on self-initiated postings could be supported by the comparison of responding patterns between assignment-directed postings and self-initiated postings. Restricted to the requirements of the assignments, many students' assignment-directed postings got no response from others, and some students' posting got only one response. When we examined self-initiated postings, greater interaction was found in the responding pattern of self-initiated postings. We found two examples that respectively got 6 and 7 responses involving negotiation among participants in self-initiated postings. Besides, the questions displayed in assignment-directed postings are rarely answered (18%); however, in self-initiated postings, approximately 60% of the questions were answered. Moreover, up to 66% of the questions raised by students in self-initiated postings gained responses from other participants of this project. Its percentage is higher than that of the teacher's and teaching assistant's answered questions (57.1%). It reveals that students in this class tended to answer questions raised by their peers rather than those raised by the teacher or the teaching assistant. These results not only indicate that self-initiated postings show more varieties in terms of its responding patterns but also imply that students behave more like a learning community and the teacher and the teaching assistant are outsiders of this community.

4.2 Effects of asynchronous discussion on college English learning

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[1] extracts are messages transmitted from other boards within the BBS or some interesting poems or lyrics

Though this English discussion forum was not utilized widely and efficiently as we predicted, it did benefit the participants in this project to some extent. 26% of the class positively indicated in the Evaluation Questionnaire that they liked the implementation of BBS into the Freshman English course; around 67% of the class claimed that the idea of practicing English on BBS did trigger their motivation of learning English. When it comes to the effects of BBS on in-class discussion, the instructor and the teaching assistant pointed that there seemed no great differences between FOL and FNOL in-class discussion. During both FOL and FNOL discussion, there seemed no much interaction among the whole class. Whenever the leader of each group finished an oral report, no volunteer from other groups was willing to offer some comments or raise questions. Nevertheless, based on students' Evaluation Questionnaire responses, around 82% of the students asserted that if they had an on-line discussion before the day of in-class writing, they would know better how and what to express in English during the in-class discussion. About 9% of the class regarded asynchronous on-line discussion as an extremely beneficial aid on their in-class discussion. Compared with the effects of BBS discussion on in-class discussion, discussion on BBS seemed to be more helpful for in-class writing than for in-class discussion. Approximately 73% of the students indicated that on-line discussion helped them understand how and what to write for their in-class writing. Up to 22% of the class viewed the on-line discussion as a great supplementary for their in-class writing. Some students also claimed that they have learned some grammar knowledge and got opportunities to comment on others' ideas via on-line discussion.

Table 1 shows the comparison of FOL and FNOL writing performance. The FOL and FNOL papers from 44 students[2] were graded by two raters, whose inter-rater reliability reaches 0.7. Then, t-test was employed to compare FOL and FNOL writings. The results show that with on-line pre-writing discussion, students performed significantly better on the total score, organization, vocabulary, and language use, but not on content and mechanics. It indicates that asynchronous on-line pre-writing discussion led to better writing, particularly on organization, vocabulary, and language use. What interesting in Table 1 is the significant improvement of the language use and vocabulary in FOL writings. According to students' Background Questionnaire responses, they viewed grammar and vocabulary as the two parts that they had more difficulties in English writing. Based on the comparison of FOL and FNOL writing performance, asynchronous on-line pre-writing discussion seems to help students' language use and vocabulary in English writing.

Table 1
Comparison of FOL and FNOL Writing Performance

	FOL	(N=44)	FNOL	(N=44)			
	Mean	SD	Mean	SD	df	t-value	p
Total	69.98	20.77	67.54	21.86	43	3.621	*0.00077
Content	20.91	2.82	20.44	2.93	43	1.676	0.10098
Organization	15.52	0.999	14.88	1.188	43	3.789	*0.00047
Vocabulary	14.93	0.79	14.32	0.48	43	4.687	*2.8E-05
Language Use	15.57	2.02	14.94	1.84	43	3.345	*0.00172
Mechanics	3.03	0.05	2.94	0.096	43	1.48	0.14612

*p<.05 E-0.5 = 10^{-5}

5 Conclusion

From the results of this project, we find that the utilization of the BBS is not as efficient as we expected. According to students' Evaluation Questionnaire responses, we assume that the low utilization of this class-based bulletin board might result from three aspects: technical problems, the design of activities on BBS, language mode, and individual habits. Due to some inevitable factors, this class-based discussion forum was not allowed to be built on the most popular BBS on campus—The BBS of Computer Science (CS), and it was alternatively built on the BBS of Materials Science & Engineering (MSE). During the semester, we discovered that it was hard to trigger students' motivation to connect to the BBS of MSE because the BBS of MSE was lack of much merit that the BBS of CS has. Approximately 87% of the

[2] Of the 45 students in this class, one student's writing is excluded because he did not participate in FNOL in-class writing.

students in this project claimed that if the English discussion forum were built on the BBS of CS, maybe they would utilize it more frequently. Besides, students had to do some activities as the required assignments on BBS during the 18 weeks. The reading of a great amount of postings as requirements could be a problem that blocked students' use of BBS. It is possible that students had been exhausted in posting assignments, so not much energy left could be used to interact. Moreover, students' unwillingness to post in English and their individual habits of using BBS might be another two main obstacles. For most of the students, they did not get used to write English messages yet. They felt more comfortable while posting in their native language—Chinese. Some students further indicated that they did not like posting articles in Chinese on BBS not to mention posting English messages. They suggested that we pay some concern on this issue if there will be implementation of BBS in the future English course.

Though the utilization of this discussion forum is not as efficient as we predicted, the results do have some implications for the teaching and learning of college English writing. First, this project lends support for the hypothesis that asynchronous on-line pre-writing discussion leads to better English writing quality, particularly in organization, vocabulary and language usage. Therefore, English teachers may adequately integrate BBS discussion into writing classes in order to help students' quality of in-class writing or writing drafts. Second, once students are required to do some in-class oral discussion or oral presentation, they could be allowed to have asynchronous discussion first because on-line discussion helps learners' preparation for the in-class oral-discussion. Third, given an authentic environment for communication on BBS, English learners will be permitted to make communication for various purposes in the target language—English—beyond the classroom. Based on the benefits mentioned above, we suggest English teachers who are interested in the implementation of BBS be careful of the possible obstacles of blocking the utilization of BBS mentioned above and carefully design CMC activities on BBS to trigger students' motivation of English discussion on BBS. It might help lead the class to take advantage of BBS more efficiently and learn English more cooperatively.

Since little research is conducted on the effects of asynchronous conferencing on English learning, there is still a need for more explorations on this area. We would like to offer some suggestions to those who are interested in future research on how asynchronous conferencing, particularly BBS, aids English learning in the following. First, time limitation is a crucial factor that lowers the reliability if this project, so future researchers may design a more complete project that lasts more than one semester. Second, in order to increase the reliability and validity, future research needs to be replicated with more than one set of writings (e.g., two comparative pieces of writings). Third, future researchers might analyze interaction patterns of postings in a more systematic way, maybe some more interesting implications about how BBS helps form a virtual community for English learning will be found in future study. With the popularity of BBS among college students, BBS should have the potential to become a significant supplement in college English course. We also encourage those who are interested in this topic replicate this study in order to examine more effects of BBS on English learning.

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Web Speaking: A Language Learning System in the Web

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Due to recent technology advances, an increasing number of applications are being ported to the Web at rapid pace. Such applications include Web Phone, Web Fax, Web BBCall, to name a few. Among others, network education has emerged as an important Internet application since it not only avoids the limitation of physical learning locations but also keeps the flexibility of teaching time. In this paper, we develop an interactive language learning system in the Web, called Web Speaking. By using Web Speaking, students are able to learn languages anywhere at any time as long as a Web interface is provided. Web Speaking is in essence a two-tier client-server architecture, and is divided into two components, namely (1) the language learning player at the client-side and (2) the course content provider at the server side. In this system, we put not only the course content but also the corresponding audio files in the server side in order to support a multimedia-teaching environment. The language-learning player runs at the client side and provides a user interface to access the course materials in the server. In addition, Web Speaking is able to improve the language speaking ability of the students with the display of the speech waveform which is generated by using the algorithms isolating the utterances of the speech. Students can capture the difference between the waveforms of their own speaking and the standard one provided by the instructor, and improve their speaking accordingly. By this language learning package, we can automate the procedures of preparing audio course materials, greatly facilitate the language learning by the students, and conduct data mining on student behavior. The teaching quality of language learning can thus be improved.

Keywords: **Distance learning, speech analysis, two-tier client-server architecture, World Wide Web**

1 Introduction

Recently, an increasing number of applications are being ported to the Web at rapid pace, including Web Phone, Web Fax, Web BBCall, and so forth. Among others, network education has emerged as an important Internet application since it not only avoids the limitation of physical learning locations but also keeps the flexibility of teaching time [1,2,3,5,6,7,8]. Traditionally, the students have to be present in the language-learning classrooms and use specific language learning mechanisms to improve their speaking ability. However, the major disadvantage of the traditional language learning is the limitation of time and space. For example, the students may have an English class in the Monday morning at the language-studio classroom and that class could be their sole opportunity to practice their language speaking, since the instructor is only present at that moment. Consequently, the effectiveness of the traditional language-learning systems is limited.

In this paper, we develop an interactive language learning system in the Web, called *Web Speaking*. The Web Speaking system we developed in the Computer and Network Center at National Taiwan University is in essence a two-tier client-server architecture. Through a Web interface, the students are able to not only learn the lessons anywhere at any time but also practice their speaking at leisure pace, thus overcoming the limitation imposed by time and space. In addition, using Web Speaking, students can communicate with the instructors interactively via the mechanism provided, and the teachers can timely edit the course materials

by writing the content of text and recording the audio files in response to the students' requests very easily. These are the very advantages of Web Speaking over some stand-alone commercial language-learning applications which are usually lack of interactive features.

In addition, the other major contribution is to provide the displays of the speech waveforms produced by the teachers and the students to help the students to learn language speaking better. In Web Speaking, we implement the algorithms isolating the utterances of the speech [9,10] to improving the students' speaking ability. Through the display of the speech waveforms, students can perceive the difference of the speech waveforms between their own speaking and the one prepared by the teacher, and improve their speaking accordingly by themselves.

Web Speaking has been distributed to some language learning groups in our campus for experimental use and been well received thus far. It is worth mentioning that Web Speaking system is meant to help the teachers to improve their teaching quality, and should be viewed as an auxiliary tool for teaching. By no means do we assert that Web Speaking is able to completely replace the role of an instructor or in any way to lessen the need for a teacher to personally interact with students. We believe that by exploiting the availability of Internet, Web Speaking is very instrumental to the traditional in-class teaching and will improve the quality of teaching results significantly from both the perspectives of students and instructors.

The paper is organized as follows. Section 2 depicts the whole system architecture. Section 3 presents the implementation and functionality of the Web Speaking. Section 4 concludes this paper.

2 The System Architecture of the Web Speaking

We use a two-tier client-server architecture for the Web Speaking system. The reason of using the two-tier client-server architecture is that it can provide our two key components, i.e., the language-learning interfaces at the client side and the course content provider at the server-side. This architecture can be easily extended to a three-tier one if an additional gateway is required in this application.

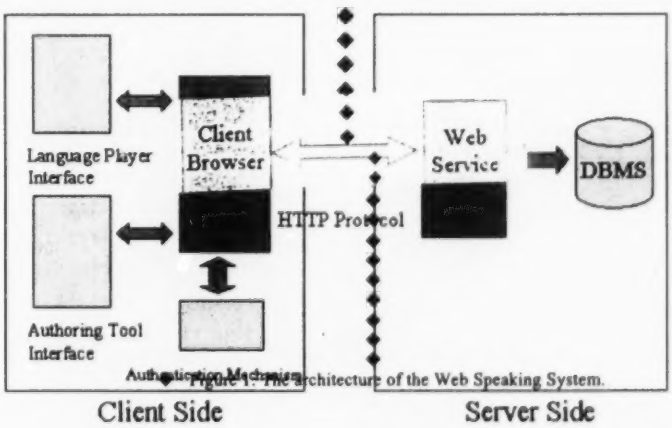

Figure 1. The architecture of the Web Speaking System.

Based on the two-tier client-server architecture, the Web Speaking System is designed as the Figure 1. At the client side, both the language player interface and the authoring tool interface use the DBMS (Database Manager System) to access the course materials in the server via the HTTP protocol in the Internet/Intranet. The program at the serve side then accepts the requests from the clients and returns the results of the requests to the clients. The DBMS at the server side saves not only the course materials but also the information of the users, including the students and the teachers. Using an authentication mechanism, the player is able to verify the user identification via the Web and to provide different user interfaces for students and teachers, as one form of personalized service. For instance, the students are only allowed to use the language player interface whereas the teachers can use both the language player interface and the authoring tool interface. The following subsections will introduce the operations of the Web Speaking System briefly.

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2.1 The language learning player at the client side

To assist the students in language leaning on listening and speaking, the user interface (UI) of Web Speaking provides the functions of playing the audio files and those of recording the user's voice. Furthermore, the UI displays the wave shapes of the audio files and the user's voice for users to capture the differences and to improve their speaking. For example, once the user selects one topic of the course in upper-left area of the Figure 2, i.e., "There are always two sides to everything." In Figure 2, not only will the content be shown in the upper-right area but also the shape of this audio appears in the middle area. When the users are playing back the audio in the middle area, an indicator will run along the shape of the audio to indicate the exact timing of audio playing.

In addition to listening the audio and watching the shape of it, the users are also able to record their voice into the system, play it out, and compare its shape with the standard one in the course material. In order to prepare the course materials easily and automatically, Web Speaking provides an interface to authorize the use of course materials and to upload and download materials automatically from the course content provider. This is a very convenient feature for the teachers who are not familiar with the operations of the transmitting files in the Web. Furthermore, the teachers could edit the content of the course material and record the audio easily via this interface, such as adding a new topic of the course material or creating a new course in the upper-right area in the Figure 3. They can also playback and record the audio file of the course materials in the bottom area. As such, the language-learning player, including the language learning interface and the course material authoring tools interface, runs at the client side and provides a user interface to access the course materials in the server. In addition, we use the algorithms isolating the utterances of the speech to display the speech waveform in order to facilitate the language learning of students.

Note that the user needs to use the local resources, such as the I/O of the audio interfaces and the I/O of the storage interfaces at the client side. However, this I/O access is not allowable for the browsers, such as the Internet Explorer and the Netscape Navigator. Therefore, we implement a stand-alone language-learning program at the client side by using the Microsoft Visual Basic 6.0 programming tools.

2.2 The course content provider at the server- side

The major tasks of the server are to save and update the teaching materials and to query the databases when so necessary. These tasks are implemented by using the PHP script language and MySQL database at the server side. Since the PHP script language has been integrated with MySQL database, we use it to query the databases (MySQL). The client can then use the HTTP protocol to communicate with the server.

The course content provider is mainly a server combining the Web service and the database manager. It employs the PHP script language to access the MySQL database and to response the client's requests. As mentioned earlier, the server side of Web Speaking saves not only the contents of the courses but also the corresponding audio files in order to support a multimedia-teaching environment. Once the server gets a request, the content provider fetches the requested materials by the user from the database, and then, if the corresponding authentication succeeds, returns the result to the client.

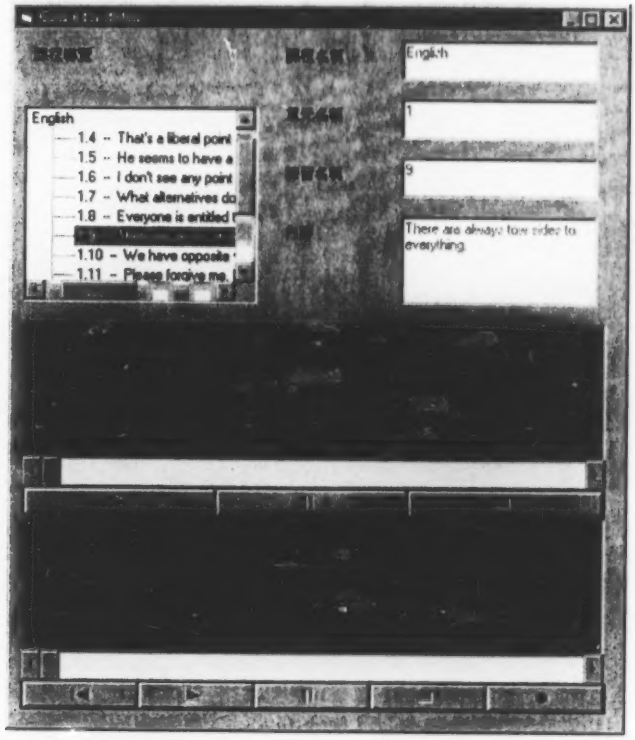
English
1.4 -- That's a liberal point
1.5 -- He seems to have a
1.6 -- I don't see any point
1.7 -- What alternatives do
1.8 -- Everyone is entitled
1.10 -- We have opposite
1.11 -- Please forgive me.
English
1
9
There are always two sides to everything.

Figure 2: The language-learning player for the students

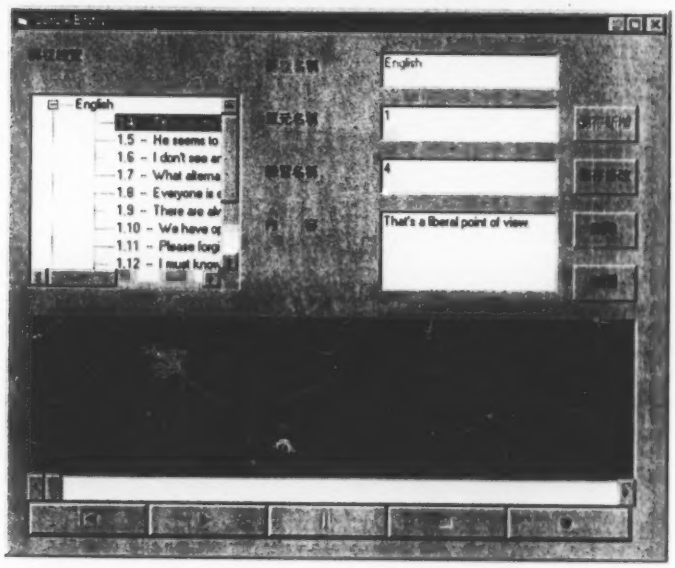

Figure 3: the authoring tools for the teachers

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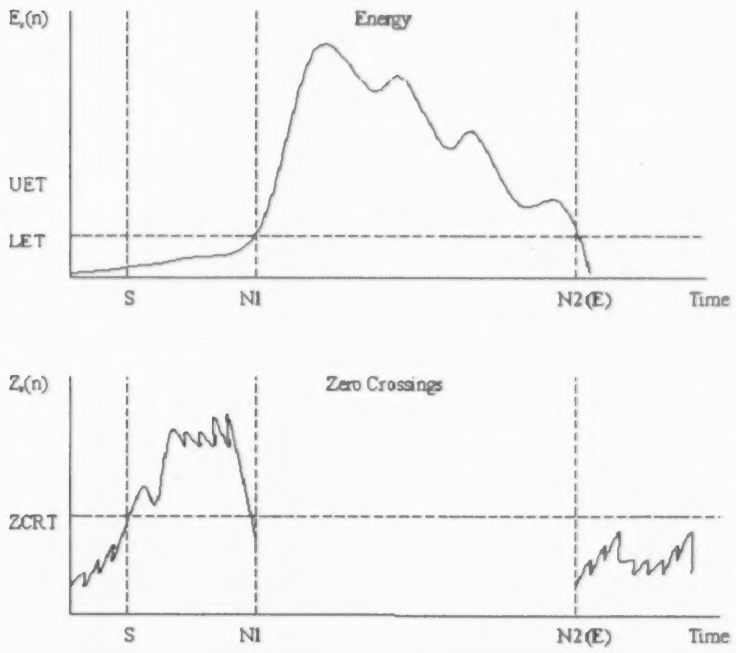
3 End Point Detection for Speech in Web Speaking

We introduce in this section the algorithm used to detect the endpoints of isolated utterances. To help the user learning the language speaking, we display both the waveforms of the speech produced by the user and the standard one prepared by the teacher. In addition, we isolate the utterances of the speech to help the user to understand how the speech looks like. This endpoint detection method [10] uses two parameters, i.e., the short-term energy ($E_s(m)$) and zero crossing rate ($Z_s(m)$), to detect the endpoints of an utterance. These two parameters are calculated as follows, where s(n) means the speech signal, w(n) means the window function, and N means the length of the window.

$$E_s(m) = \sum_{n=m-N+1}^{m} s^2(n)$$

$$Z_s(m) = \frac{1}{N} \sum_{n=m-N+1}^{m} \frac{\left|\operatorname{sgn}\{s(n)\} - \operatorname{sgn}\{s(n-1)\}\right|}{2} w(m-n)$$

$$where \quad \operatorname{sgn}\{s(n)\} = \begin{cases} +1, & s(n) \geq 0 \\ -1 & s(n) < 0 \end{cases}$$



◆ Figure 4: Illustration of the endpoint detection algorithm.

The endpoint detection algorithm is depicted in Figure 4 and described below.

Step 1. Assume that the window function *w(n)* is a rectangular function with the window size *N* being 10 ms, and the first 100 ms of the speech signal is background noise. Then, use this signal segment to calculate the mean and variance of $E_s(m)$ and $Z_s(m)$.

Step 2. Using the statistics derived from Step 1, determine three thresholds, i.e., the upper energy threshold (UET), the lower energy threshold (LET), and the zero crossing rate threshold (ZCRT).

Step 3. Search from the beginning until the energy $E_s(m)$ exceeds the threshold UET. Then, run backward until the energy $E_s(m)$ falls below the threshold LET. We call this point the tentative beginning point N1. The tentative ending point N2 is calculated in a similar way.

Step 4. From the tentative beginning point N1, we examine the zero crossing rate for the previous 250 ms

signal segment. If there are more than three occurrences of counts above the threshold ZCRT, we select the first point backward from N1 whose zero crossing rate is higher than ZCRT as the beginning point (S) of the word. If there are no more than three occurrences of counts above the thres hold ZCRT, the tentative beginning point N1 is directly selected as the beginning point of the word. The ending point (E) is decided in a similar way with exception that the forward searching direction replaces the backward one.

By using the above algorithm we can partition the waveforms of the speech. Furthermore, the language-learning player displays the shapes in the screen and also indicates the timing when the waveform of the speech plays. Thus, this functionality of the language-learning player offers not only the playout of the audio but also the display of the waveform shapes at the same time. This is a very helpful feature for students to learn language speaking.

Note that we can collect students' practicing records in the Web Speaking system. Through some data mining techniques, we can find useful information about the student behaviors, e.g., the common mistakes made by the students. Clearly, using such information discovered, the instructor is able to improve their language teaching by reminding the students of how to speak better when the students encounter common problems.

4 Conclusions

In this paper, we developed a Web Speaking system to improve the language learning and teaching for the students and the teachers. By using Web Speaking, the students are able to not only learn the lessons anywhere at any time but also practice their speaking at leisure pace, thus overcoming the limitation imposed by time and space in traditional teaching environments. The advantage of Web Speaking over some stand-alone commercial language-learning applications lies in the full interactivity Web Speaking provides. The other major contribution is to provide the displays of the speech waveforms produced by the teachers and the students in order to help the students to learn language speaking better. Through the display of the speech waveforms, students can perceive the difference of the speech waveforms between their own speaking and the one prepared by the teacher, and improve their speaking accordingly by themselves.

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